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In Memoriam

GEORGE GREY TURNER

Hon. D.Ch. (Dunelm), Hon. LL.D. (Glasg.), M.S. (Dunelm), F.R.C.S., Hon. F.R.A.C.S., Hon. F.R.C.S. (Edin.), Hon. F.A.C.S.

(1877–1951)

THE sudden death of George Grey Turner a few days before his seventy-fourth birthday robbed the world of a master-surgeon, respected, revered, and beloved wherever surgery is practised throughout the world. Yet none can repine the manner of his passing, for who would not wish, like Caesar, to " go off at one blow rather than to be sawed in pieces by the grating torture of disease " ?

His early life in the Northumbrian medical school has been referred to by others ; he graduated from Durham University in 1898, before almost every present-day reader of the BRITISH JOURNAL OF SURGERY had embarked on the study of medicine and long before very many had even been born. He obtained the Fellowship of the Royal College of Surgeons of England in 1903. The list of his academic honours would fill not a page, but a volume. He was a Member of the Council of the Royal College of Surgeons from 1926 to 1950 and its Vice-President from 1937 to 1939 ; he was Hunterian Professor, Bradshaw Lecturer, and finally Hunterian Orator, and was one of the Hunterian Trustees. At various times Grey Turner was Orator and President of the Medical Society of London, President of the Association of Surgeons, and President of the Surgical section and of the Section of Proctology at the Royal Society of Medicine ; he had been recently elected President of its Clinical Section to give it an impetus, but death claimed him before he occupied the Chair.

Across the Atlantic he delivered the Murphy Oration, the Balfour Oration, and was the only British recipient of the Bigelow Medal. For many years he was British delegate to the Council of the International Society of Surgery, and in 1949 he enjoyed the signal honour of being President of the Thirteenth Congress of the International Society of Surgery, an honour which he shared only with Sir William Macewen among British Surgeons.

Grey Turner was for many years a member of the Editorial Committee of the BRITISH JOURNAL OF SURGERY and an honoured member of many Surgical Societies at home and abroad ; he was the last surviving Founder Member of the Moynihan Club, Harold Upcott having predeceased him by only a few months.

Grey Turner's surgical life was biphasic, and though few would deny that his powers were at their zenith in his Newcastle days, the second period of

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work at the newly-created Postgraduate School at Hammersmith saw no abatement of his unquenchable enthusiasm, his beaver-like industry, or his surgical skill.

Grey Turner owed much in his early years to Rutherford Morison and also to Bland-Sutton. He was one of the giants of surgery in the days before specialism had made so many encroachments on the

province of the general surgeon. If the operating theatres of Bland-Sutton and Moynihan had been in chronological sequence the lodestone which attracted surgeons in the end of the nineteenth and the first two decades of the present century, Grey Turner's theatre was the Mecca in the third and fourth decades, alluring surgical pilgrims not only from the length and breadth of Britain, but from transatlantic shores and from across the Channel and the North Sea. He was never the Herrick among operators that Moynihan was with his lovely, flawless artistry; he resembled Bland-Sutton more closely, not only in his great enthusiasm for and knowledge of pathological material and museums, but in his great surgical self-reliance and ability to work alone. No array of skilled and experienced assistants was necessary to enable him to bring the case to a successful conclusion, and the period of his greatest and most illustrious achievement preceded the modern era of wonderful anæsthesia and anæsthetists, the screen of antibiotics, and the limitless stores of blood. Just as the story of the ruptured extra-uterine gestation was unravelled in the top back rooms of the Euston Road by J. B-S., with a courteous and skilful French doctor who found the cases and functioned as assistant, so did Grey Turner graduate in "hillside cottage surgery", training himself in the art which was in the fullness of time to mature and bring aid to unfortunates with congenital malformations of the bladder and external genitalia and to furnish hope and encouragements to surgeon as well as patient in the treatment of malignant disease.

Where so much had been achieved by his art, it is difficult to place a finger on that which gave him most pride, but perhaps his work on the surgery of the œsophagus may have seemed his *chef d'œuvres*, for at least the Bigelow and Hume Memorial Lectures were devoted to its consideration. Achievement in this field was not to be obtained without hard endeavour and disappointment; it demanded perseverence and fortitude undaunted by setbacks. He could from his own experience re-echo the well-known lines:—

> Then welcome each rebuff
> That turns each smoothness rough,
> Each sting that bids nor sit, nor stand but go!
> Be our joy three parts pain,
> Strive, and hold cheap the pain:
> Learn, nor count the pang: dare, never grudge the throe.

Norman Hodgson has written that "during my close association I cannot recall one instance of any display of irritation in any circumstance". There was courtesy to all: "please" and "thank you" were keys to men's and women's hearts and a talisman to loyal efficiency.

He came to London late in his career and only after reaching "the other side of the hill", as Sir Walter Scott in his happy phraseology designated middle age; but although in the fullness of time he became a Freeman of the City of London, he never really was *of* London; his roots were in his beloved Tyneside: he loved the Roman Wall of Hadrian, and Bede's monastery at Jarrow; he was a regular visitor to the Border Shepherds' annual show, and his big heart was faithful to the moors and dales and the ballads of the Borders, and he remained a true Northumbrian to the end.

Advancing years appeared to impose little or no decree on his surgical thrust: even the psalmists three score years and ten were fresh and green, and because of the length of the Second World War he continued to act as Professor of Surgery at the Post-graduate Hospital until he was in his seventieth year; to the end of his sojourn there he retained his almost boyish enthusiasm for everything connected with surgery.

Even in the eighth decade of his life his energy was still restless; his had been the active life of a master-surgeon, and it is hard to lay aside the tools of the trade. His pen was not idle, and his knife at times came to the aid of those who looked towards him for assistance. Apart from the writing of books, he most readily and at all times gave of his experience to help and encourage younger colleagues.

As Grey Turner himself wrote in his Macewen Memorial Lecture: "Great men are like mountains; one cannot realize their greatness until one stands at some distance from them." The lessons of his life cannot yet be truly appraised, but in the cool judgement of posterity his name will stand out as one of the brightest stars in the surgical firmament.

As John Hunter was known as "the dear man", so will G. G. T. be thought of by his old friends, for he had to an exceptional degree the gift of friendship; no friend was ever more considerate and painstaking and unfalteringly loyal.

In the happiness of his family life, with hosts of admiring and loving friends in every quarter of the globe, proud of the myriads of surgical acolytes whom he had taught and trained, and who carry on the Grey Turner tradition; not unmindful, yet full of humility, of the contribution which he had made to surgery, and perchance, if he ever had the time for contemplation, happily aware of that generous sum of physical health and moral uplift that he had conferred on so many, he might have reflected:—

> From quiet homes and first beginning
> Out to the undiscovered ends
> There's nothing worth the wear of winning
> But laughter and the love of friends.

This lovable little man had attained greatness at an early age that might compare with Pompey and Pitt; yet there was no decorous facade, but transparent honesty and kindliness; the bent figure, the ambling gait, the sudden stop for a quiet chuckle, the bowler hat seemingly too big and perched on the back of his head. Like Gladstone, there were the frequent postcards with some comment or reminder; the much-used envelopes; the wonderful demonstrations of old patients, especially the long-time survivors of cancer operations, and the confidence and affection that he inspired in all who were fortunate to be under his care.

Perhaps towards the close of his life his mind may have gone back to those dying words of the great Master of Balliol, Benjamin Jowett—"Thank God for my life".

Virtus recludens immeritis mori caelum.

G. G-T.
C. L. R.

FRANK T. PAUL—HIS LIFE*

"I WAS born on a large farm in Norfolk between Lynn and Swaffham, on December 3, 1851, the year of the 'Great Exhibition'."

With these words Mr. Frank T. Paul began an account of his long life and of the surgery of his time. His manuscript, written at the age of 82 and now in the possession of the Liverpool Medical Institution, has been used to prepare this publication on the occasion of the centenary of his birth.

It is with regret that parts of the original text have had to be omitted but all that follows comes directly from his pen.

At the early age of 8 I was sent to school at Downham, at 13 moved to Lynn, and at 15 had a final year at the Yarmouth Grammar School under the care of Dr. Raven. At 16 my father, who had not much faith in farming, sent me to London as a clerk in a Colonial broker's office. The work was about as dull and uninteresting as it could possibly be, and I begged to be allowed to study to become a doctor. This was arranged, and I was to have been apprenticed to a well-known Norwich physician; but my uncle, a very kind-hearted practitioner in Lynn of the old type and traditions, on going into the matter discovered that the physician, a London M.D., did not possess the essential L.S.A. Consequently I had to be nominally apprenticed to my uncle—who was L.S.A.—and sent to Guy's. This was carried out as soon as the entrance examination was passed.

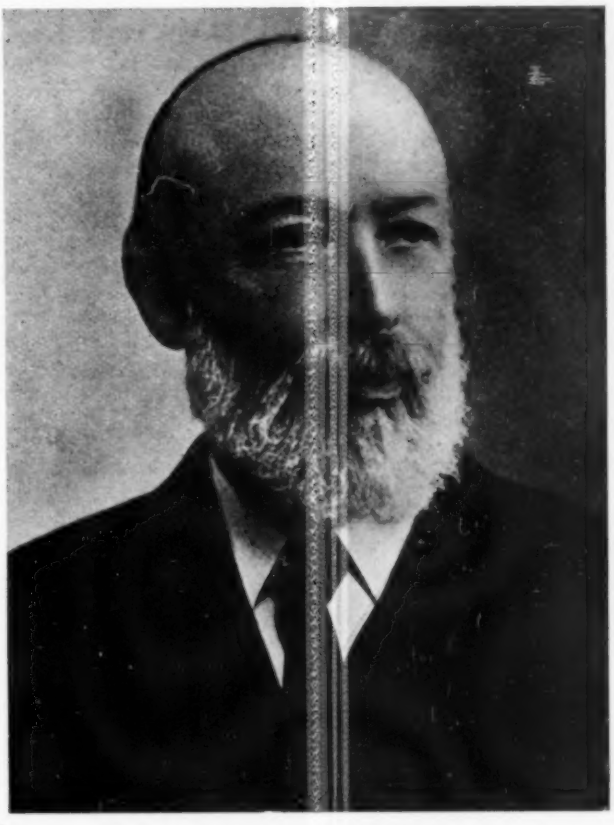
At Guy's my uncle arranged that I should be apprenticed to Mr. Stocker, the apothecary. He lived in the Quad, and had an office in the hospital. He managed the large dispensary and I think he looked after the students' fees. Also he had some night responsibility in the wards. I entered the dispensary in August. Being always a keen worker I soon picked up a lot of knowledge about drugs. We made all the tinctures, extracts, ointments, pills, and plasters. I soon took to the job, and could spread the 10 feet strips of strapping almost as well as the old hermit who presided over this work in the cellar. Upstairs there were also two old fossils who made up the medicines ordered on the out- and in-patients' cards. They had no objection to my help, and so I put up countless gallons of physic, and had the good luck to poison no one.

As the winter session advanced, anatomy and physiology took up increasing time. My nature was always of the impressionable type, and I shall never forget the shock of the first view of the dissecting room, nor the horror with which I saw Durham plunge a knife into a man's leg to cut it off.

Although the Guy's Staff did these horrible things we were very devoted to them, and I have happy recollections of them all, especially of Durham, Parry, Swain Taylor, Stevenson, Wilks, Owen Rees, Moxon, Fagge, Pye Smith, Goodhart, Braxton Hicks, Phillips, Bader Howse, Davies Colley, and others.

I went through the delightfully practical course of work for which Guy's has such a very well deserved reputation, and qualified L.S.A. and M.R.C.S. at the age of 21, and a little later the L.R.C.P. I had also the first F.R.C.S., and was too young to think yet of the final.

If I had known there was such a place as the London University and what it meant when I was working for the entrance examination, my career would perhaps have been different. It was only after a year at Guy's, that one recognized there were two classes of students—University men and others. I belonged to the latter, and the only higher qualification open to me was the F.R.C.S. Surgery was at a low ebb in those days. Histology and pathology especially appealed to me, and they inclined to lead on to medicine, from the higher walks in which I was practically barred.



FRANK T. PAUL, 1851–1941

After qualifying I had my best two years at Guy's during which I held the three resident posts: Resident Obstetric, House Surgeon, and House Physician.

I commenced as junior Obstetric with Henry Ashby, one of the best of men and a life-long friend, as senior. We were on duty at Christmas time when

* These autobiographical notes were written by the late Mr. Paul at the request of Mr. H. R. Bickerton, when he was preparing his *Medical History of Liverpool* (London: John Murray, 1936). The manuscript is now the property of the Liverpool Medical Institution, to whom, together with Mr. Bickerton, we are indebted for permission to publish.

all the externs deserted us, and left us to attend all the cases without any help. It was my duty to go first, then Ashby's, and then Dr. Phillips, and lastly Dr. Braxton Hicks ; but I believe by desperate work we managed to save the Staff. We had a lot of useful experience especially in looking after and teaching the externs. I particularly recollect one case in which the extern raced back to the hospital in a hansom—no telephones or motors in those days —to tell me that he had been called to a patient with terrible hæmorrhage and had plugged the vagina. When I arrived the poor woman was dead. No blood near the uterus but plenty on the floor. She had died from a burst varicose vein in the leg.

Next I came on as junior House Surgeon and had charge of the Surgery with a large bevy of dressers to assist. It was here that I first applied the Listerian treatment to a wound, and the result was so remarkable that I can picture it still. These were the days of pyæmia, septicæmia, hospital and gas gangrene, erysipelas, and all such scourges. The wound was caused by a cloth-teazing machine which had ripped up the back of both hands exposing all the tendons. The ordinary course of such a wound was septic infection, with double amputation and probably death. I cleaned the wounds and dressed them with carbolic oil, and they healed entirely by first intention. It was the first time that I had seen anything of the kind. We had largely to thank Howse for introducing against some opposition the Listerian treatment, and so starting the great revolution in surgery.

The senior House Surgeon had charge of all the surgical wards, and a very busy time it was. During the day he was at the disposal of the Surgeon on duty ; but after five o'clock he had entire responsibility. When I left Guy's the practical character of the training was well illustrated, for I was well versed in minor surgery, and had done some major operations such as amputation and herniotomy.

Following the House Surgeoncy came the post of House Physician which was very enjoyable with a real good colleague in Henry Hetley. The junior's work was in the out-patient room. A medical clerk interviewed all the patients applying. He had supreme power and could select those he liked for the clinical ward. I remember an Assistant Physician wishing to keep a case, but the medical clerk was adamant and would not give in. After the clinical demands were satisfied he distributed the cases to the Assistant Physician and the junior House Physician, the former being supposed to have the best cases, but not quite always getting them. Anyway the latter had an experience given to few young practitioners, and if he did not know something in the way of diagnosis and treatment at the end of his term, he must have been a poor specimen.

Wilks, Moxon, and Fagge, were the favourites. The first in his quiet way seemed to know everything and was specially good in all nerve cases. I very soon made a mistake in one of these. This was a patient, a woman, whom I admitted bleeding rather profusely from the mouth, and coughing and choking so that she seemed on the verge of expiring. I hastily did a laryngotomy apparently to her great comfort. When Wilks came to her bed he looked at her quietly, and then said " Were you not once an out-patient under the care of Sir William Gull ? " She admitted it, and he told us that Sir William wrote her a prescription for a skipping-rope and a donkey. The fact is she was a confirmed hysteric, and was repeating the old experiences on a new generation. Needless to say, as soon as I had the ward to myself I took out the laryngotomy tube, and the patient rapidly recovered.

Wilks was always interested in fevers. Typhoid was fairly frequent, and " perityphlitis " was occasionally mistaken for it. This was a rare disease then. What a change since! Typhus was not uncommon. We always took in typhus cases when they came along. Wilks said they never spread as they were not contagious beyond three feet from the patient, and I don't recall one that did. It was at this time that I caught the scarlet fever. This happened when I was run down as a result of exceptional work and it hit me hard. I believe Fagge thought I was done for ; but after a short doubtful period I pulled myself together and recovered. But now my time at Guy's was really up and it was imperative for me to find a paid post as quickly as possible. Fortunately a suitable one was advertised very soon. The Liverpool Royal Infirmary wanted a Resident Medical Officer. It was a fine hospital, and connected with a Medical School. Consequently I applied and had the good fortune to be appointed.

Before leaving Guy's I received a hint that it might be worth my while to stay on. But I had not the means, and for the past 18 months had lived chiefly on prize money which I kept for the purpose. So I posted off to my new home in Liverpool.

The R.M.O. post at the Liverpool Royal Infirmary was new. Under the R.M.O. there was to be a house surgeon or house physician for each member of the staff. The staff was a good one. Edward Bickersteth, the Senior Surgeon, was a quite exceptional man with a large practice. He was a personal friend of Lord Lister, and was the first man I saw who dressed properly for an operation. The usual custom was still to use a dirty old frock coat. Reginald Harrison and Mitchell Banks were younger surgeons, the latter having been recently promoted. Rushton Parker was pathologist, but I shared a fair amount of the work with him. I made 3000 post mortems before I gave it up, and found it a great help later in life. At that time there were no special anæsthetists, and apart from ward work and some clerical duties I gave anæsthetics, usually ether, and this was another experience which was very useful to me.

After three year's hard work at the Royal Infirmary, and keeping in touch with the Medical School, it became time for me to move on. Mr. Shadford Walker, the ophthalmic specialist, made me his assistant. In the meantime, slack as surgery was then, I managed to get my foot on the first step of the ladder, greatly assisted financially by helping Harrison and Banks in their private work. When I left the Infirmary as a Resident there were plenty of opportunities for work outside. I became Surgeon to an active and popular hospital, the Stanley, in the north part of Liverpool, taking on a post previously held by Rushton Parker. I also followed him as pathologist to the Royal Infirmary,

where to my surprise I was allowed to adopt the Guy's rule and make a post-mortem in all cases unless permission had been voluntarily refused. I hardly missed a case during my five years of office, and had no trouble.

In addition to being pathologist I had other posts at the Medical School, such as Curator of the Museum, Demonstrator of Physiology, Lecturer in Dental Anatomy, and a histology class. Plenty of work, which was made cheery and bright by some delightful colleagues, including Ashby, Mott, Briggs, Hyla Greaves, and others. Needless to say, with such men a lasting friendship was inevitable.

During these early years private patients were few. I lived largely out of anæsthetics. At this time the Clinical Research Association had not commenced its useful career, and I served as a sort of voluntary researcher for the whole district, chiefly regarding tumours and other pathological specimens. I cut many thousands of sections. Soon the Clinical Research was in full swing, and we all accepted its valuable help with thankfulness. All through my busiest operating period I sent every new growth to them and their assistance was invaluable.

After five years' work at the Stanley a vacancy occurred at the Royal Southern for which I became a candidate. My opponent was an old friend and former pupil, Robert Jones. I certainly thought that I ought to be elected and I was; but as years have rolled on, and as Robert Jones developed into a great leader of orthopædic surgery with a world-wide reputation, I recognized that I had not appreciated his capabilities at that stage of his career. Our contest was perfectly friendly, and in no way disturbed our personal relationship. Few people have so thoroughly won my respect and attachment. To the end he was always the same. Always the most charming companion. Always the most kind and helpful professional friend. I doubt if the loss of any other colleague has left that sad feeling of want caused by the empty chair of Sir Robert Jones.

At the Southern I became much interested in abdominal surgery, and attempted new methods in stomach and bowel operations, for which I had to obtain a vivisection licence. These involved the complications, usual then, of mechanical assistance in the endeavour to make the new union safer. But it was not long before it dawned upon surgeons that simple suture was better than any involved methods with metal buttons and bone plates and tubes. The latter soon disappeared and abdominal surgery became safer every day. At this time appendicitis was definitely on the increase, and the medical profession recognized the value of timely operation. I think Liverpool was particularly advanced in this. It was not long before appendicitis was quickly recognized by practitioners, and a surgeon called in.

Next I took Reginald Harrison's place at the Royal Infirmary, where I remained for twenty years, until I reached the age limit.

It was a wonderful twenty years in which the safety of operations increased astoundingly. When I came to the Royal Infirmary as R.M.O. in 1875, erysipelas, septicæmia, pyæmia, hospital and gas gangrene were rampant. One in three of the ovariotomies and breast excisions died, though done by good men. In my last years I did over one thousand consecutive breast cases without a single death, and in appendix cases, with the exclusion of five hopeless patients already suffering from *general* peritonitis, also one thousand consecutive recoveries.

Dramatic improvements in surgery began when we learnt definitely that suture was the proper method for uniting the hollow viscera, and that no kind of antiseptic could be tolerated by the peritoneum. The more septic the lesion the more intolerable and dangerous the antiseptic. Next to these was correct and efficient drainage. A favourite method of drainage with me in a certain type of case I never succeeded in getting my colleagues to adopt. This was in those large collections of pus one meets with in certain appendix cases in the lower third of the abdomen. I dilated the anus, punctured the swelling with an exploratory syringe, and finding pus opened it. I used an instrument invented by a clever gynæcologist, whose name I am sorry to say I don't know; but I carried his tool in my bag for over 20 years, and during that time out of many of these cases I did not lose one.

A type of case which at first caused me great anxiety was the excision of portions of the large bowel. This originally was a dangerous operation, and one recognized that the usual source of danger was leakage from imperfect union. It was for this I made considerable use of glass tubes, after first trying them for colotomy, for which they were not really necessary, nor usually the best method. In colectomy the tubes were very successful, and I used them subsequently in many cases.

It did not occur to me at first to think that this method of draining the bowel was a very valuable invention; but I was certainly very pleased to receive a letter from Lord Lister expressing his interest in it. When later I extended its use to drainage of the small bowel in various cases of stasis, its value became more striking. Indeed its usefulness was so apparent, and so many surgeons employed it, that it passed into general use, and I became known as Paul's-tube, and my wife has been addressed as Paul's-tube's wife. As in many other things, a simple common-sense suggestion often tells more than a profound one.

During my time the Royal Infirmary became a very pleasant hospital to work in. There had been days when the return for professional work was poor, and hard times have a great tendency to breed jealousy and discord. These passed away and relations were generally most cordial. We all worked very happily together until the daily time-piece struck "60" for me. This being the retiring age, I had the pleasure to make room for the younger generation, and transferred my energies to the Hoylake Cottage Hospital, which I claim to be the best in the country.

Of the younger men, Thelwall Thomas and Bickersteth, both very well known men, had already moved up. Litler Jones, Kelly, Jeans, and Wolfenden followed on, and well maintained the best traditions of the surgical staff.

During my final years on two occasions my younger colleagues gave me a very unexpected surprise. The first was a request from Mr. Frank Jeans to allow him to obtain a cast of my hand. I really could not take his request seriously at first,

but he persisted, and I gave in. The cast in bronze was presented to the Medical Institution, and I am afraid I felt a bit ashamed of the gift.

The other act of my Liverpool colleagues was one of such exceptional kindness and consideration that I hardly know how to refer to it. They made me a birthday gift by publishing a volume containing a selection of my papers, and presenting me with a beautifully bound copy. The compliment to me was very great indeed; but the witness it bears to the generosity and good feeling of those amongst whom I have worked for so many years is greater still.

My daily duties were of course most closely associated with practical surgery; but other matters claimed a good deal of time, especially the University and Medical Institution. When a vacancy occurred I was appointed by the former as Lecturer in Medical Jurisprudence and Toxicology. Later this post was converted into a Chair, which I held for several years, and on retiring the Senate elected me Professor Emeritus in the subject. I always hoped for a share in the Surgical teaching, but the professorship was held by a colleague but little older than myself, so the opportunity, except for clinical teaching, was not offered.

In the meantime I became Dean of the Medical Faculty, and took my part in the general working of the University. The University did me the honour to grant me the M.Ch. degree, and later the D.Sc., for both of which I felt very grateful. The Medical Institution was my "first love" in Liverpool, and I have always been greatly attached to it. I became an Associate soon after arriving in Liverpool in 1875, and it was not long before I read my first paper there. The Liverpool Medical Institution is one of the very best societies of the kind in Great Britain. It is arranged to include equally all branches of the profession. The higher honours go to the best men; but they are found in every walk. If you look at the list of past presidents you will find a very fair number of general practitioners, all of whom have been appointed strictly on their merits, and with the warm approval of all members. With me the Medical Institution came almost before anything else. I worked constantly for it, submitted all my results to it, and held almost all the working offices. It is a pleasure to feel that it is conducted on such sound lines that its success is greater than ever, and is assured for the future.

I suppose the story of a life is hardly complete without any reference to the unprofessional side. Through the week I usually worked all day from 8.30 a.m. to 11 p.m. But having been nurtured in the country its call was always felt. A long Sunday walk in the Wirral was popular, and I often had one with Bickerton, William Williams, or some other colleague. But I preferred something more stirring, and luckily a fellow house surgeon, Damer Harrison, at the Royal Infirmary, introduced me to canoeing in 1877, and I became an enthusiastic member of the Mersey Canoe Club. Having once taken up canoeing and photography I spent every holiday cruising and camping. First we did the rivers in England, Wales, and Ireland, and then the Scottish coast. The latter was an irresistible call.

I wonder now, when I am almost afraid to drive a car, how I had the pluck to risk everything in those days; Lochs Arran, Etive, and Frochan were favourite haunts, and though sheltered, were all dangerous. However, this could not last for ever. The calls of surgical practice cut out the week-ends, and made the boat practically impossible except for the regular summer holiday, and I had to find a more civilized recreation. After a few years with horses the motor car became possible, having survived the initial difficulties. I was advised to try a nice-looking small coupé built by the Rover Company. It had only one cylinder, but it was a good goer and always "got you there". My friend Robert Jones, not then of world-wide fame, also had one, and ultimately ran it for 150,000 miles.

I always drove the car myself, though some thought it "not correct" for a surgeon. But now they all drive more or less, and are so much the better for it.

I became very happily married to a young "Sister" at the Royal Southern Hospital. William Rathbone, the pioneer in nursing reform, was her cousin. He was the head of a very large County family of Rathbone and Gregs into which I was very kindly received. Mr. William Rathbone occupied a patriarchal position in the family. He was a well-to-do man who felt very strongly the responsibility of being rich, and not only gave liberally and wisely, but had great influence in leading others to do the same.

When my wife and I were married we took a small cottage in Hoylake as our country home, and some years later we built our first house in an acre of ground, sandhills, which I converted into a pretty garden. Here some of the children were born, and the house becoming too small, a Rathbone architect designed a considerable enlargement.

In 1914, when I began to take a little more time off, and Hoylake becoming somewhat built-up, I bought a lovely site on the hillside at Caldy, and built another house designed by Sir Arnold Thornley, overlooking the mouth of the Dee. It was a delightful spot and we intended to end our days there. But we cannot tell what is in store, and circumstances altered, so that in 1930 we came South to be nearer the children, three of whom were in London, and said good-bye to a beautiful home, and many long-tried friends, from whom it was hard to part. We are now settled at Grayshott in Surrey, where there are still Liverpool friends, including my old medical colleague, Sir James Barr.

Surgery has passed for ever. Indeed I am no longer "a Doctor"; but have become a gardener, pure and simple. With the Royal Horticultural Society not far away, and other enthusiastic practitioners of the art nearby, I follow it with such remnant of the old enthusiasm as may remain in the human shell at 82.

Frank Paul died in January, 1941, in his ninetieth year.

LOCAL RECURRENCES AFTER SPHINCTER-SAVING EXCISIONS FOR CARCINOMA OF THE RECTUM AND RECTOSIGMOID

By J. C. GOLIGHER, C. E. DUKES, and H. J. R. BUSSEY

FROM ST. MARK'S HOSPITAL, LONDON

The operation of abdomino-perineal excision of the rectum as first described by Miles (1910) was designed to ensure the widest possible removal of the field of lymphatic drainage. This operation and variants, such as the perineo-abdominal (Gabriel, 1934) and the synchronous combined excision (Lloyd-Davies, 1939), have been in general use for many years and there is no doubt that by these combined operations the end-results of the surgical treatment of rectal cancer have been improved. In designing the abdomino-perineal operation Miles took into account the possibility of lymphatic spread upwards along the chain of glands accompanying the superior hæmorrhoidal vessels, laterally along the course of the middle hæmorrhoidal vessels and downwards towards the inguinal group of glands. However, the dissection and examination of operation specimens has shown that downward and lateral spread is only liable to occur in growths situated below the level of the peritoneal reflection. For growths situated in the upper half of the rectum and rectosigmoid the direction of lymphatic spread is always first upwards: evidence of lymphatic spread to a level below the primary tumour is rarely found unless the upward path of lymphatic spread has been blocked by metastases, or by inflammation or subsequent fibrosis (Gabriel, Dukes, and Bussey, 1935). Since in most cases of cancer of the intraperitoneal part of the rectum or rectosigmoid region there is so little likelihood of downward spread, it is natural to ask if the sacrifice of the anal canal and sphincters can be avoided. There has accordingly been a revival of interest in sphincter-saving resections for malignant tumours in these situations, and the efficacy of these operations is now being put to the test in many hospitals in this country and in America.

At St. Mark's Hospital our series of cases so treated now totals 162. In 105 of these a low anterior resection with anastomosis (Dixon, 1939; Wangansteen, 1943, 1945) was performed; 31 had a similar resection but without restoration of continuity, the rectal stump being merely closed or covered over with peritoneum and the iliac colon brought out as a terminal iliac colostomy (Hartmann's operation); and 26 were treated by some form of abdomino-anal excision, usually by the method of Maunsell (1892) and Weir (1901). Whatever technique was employed the ideal aimed at in carrying out any of these operations was an extensive removal of the tissues of the upward zone of lymphatic spread by high division of the inferior mesenteric vessels, as in a combined abdomino-perineal excision and a wide excision of the rectum and perirectal tissues *en bloc* to a level at least 1 in. below the lower margin of the primary growth, as recommended by Westhues (1934), Pannett (1935), and Wangansteen (1945) (*Figs.* 281, 282). The immediate results obtained have been very satisfactory, the overall operative mortality being 11 out of 162 cases, or 6·8 per cent, which compares favourably with the immediate mortality-rate for the ordinary combined excision of rectum—namely 41 out of the last 545 cases treated by this operation at the hospital, or 7·5 per cent. As described in other communications

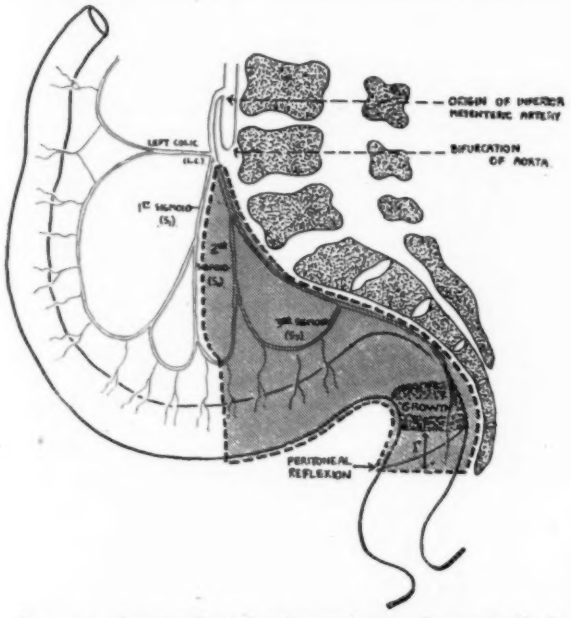


FIG. 281.—Scope of resection for carcinoma of upper half of rectum. Shaded area indicates tissues to be removed.

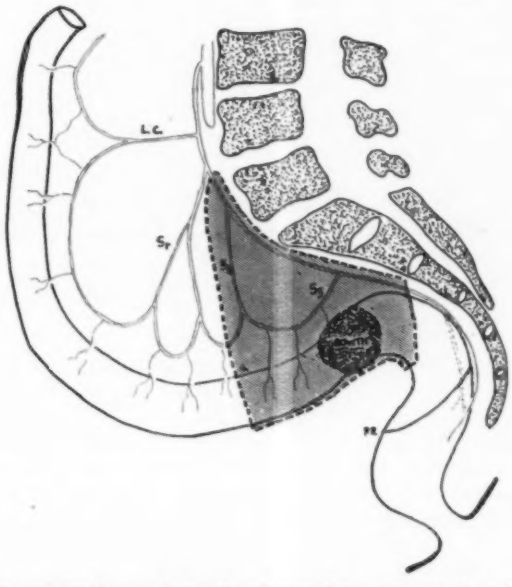


FIG. 282.—Scope of resection for carcinoma of rectosigmoid. Shaded area indicates tissues to be removed.

(Goligher and Hughes, 1951 ; Goligher, 1951), the functional condition after operation has also generally been excellent.

As regards late results, unfortunately no comprehensive statistical presentation of these is yet possible because the majority of the patients have only been treated in the last four years. But it can be stated that already the growth has reappeared

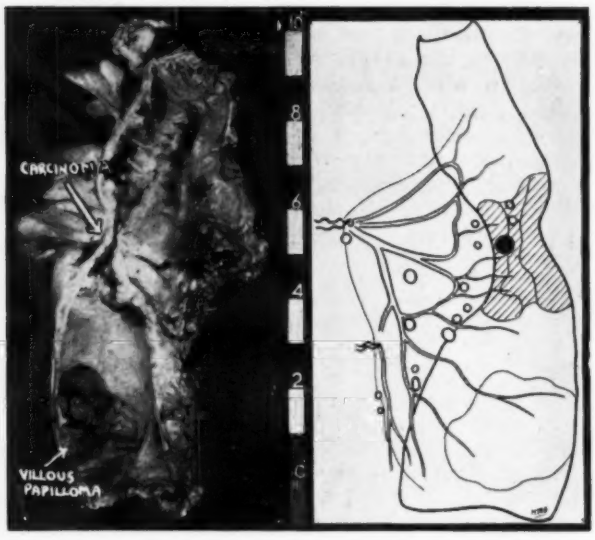


FIG. 283.—First operation specimen removed by Hartmann's operation, showing constricting carcinoma of rectosigmoid region accompanied by large villous papilloma of upper third of rectum. (*Case* 4.)

locally in 16 of these cases and, with the passage of time, further recurrences may presumably be expected. In some of these cases only clinical data, occasionally supplemented by laparatomy findings, are available regarding the recurrences, but in 9 instances it was found possible to carry out a further excision of the growth and the remnant of rectum, and in one other case a post-mortem examination was secured. The pathological material thus obtained has been carefully examined and compared with the original operative specimens. In addition we have had the opportunity of dissecting and examining pathologically the second operation specimens removed from 7 other cases of recurrence following resection operations for carcinoma of the rectum or rectosigmoid carried out in other hospitals. Thus altogether we have investigated 23 local recurrences after these operations and in this paper we shall describe and discuss the significance of our findings in these cases.

CASE REPORTS

Case 1.—G. D. H., male, aged 40. July 1, 1931 : Hartmann's operation for rectosigmoid carcinoma. Pathological report : Tumour of colloid type and confined to bowel wall (Stage I). 1 in. of normal bowel present between growth and lower end of specimen. No polyps.

One year later carcinomatous ulcer detected at upper end of rectal stump. Perineal excision of stump on Oct. 11, 1932. Recurrence of colloid type : extension through bowel wall from top end of rectal remnant ; two lymph-glands involved. Patient died April 6, 1933. ? further growth in pelvis.

Case 2.—W. J. M., male, aged 66. Sept. 4, 1936 Hartmann's operation for carcinoma of upper third Growth had not invaded perirectal tissues, no lymphatic metastases (Stage I) ; average grade malignancy. No polyps. 1 in. margin of clearance present at lower end of specimen.

Patient well till April 2, 1943, when ulcerating carcinoma found on posterior wall of rectal stump just above anorectal ring. Treated by deep X rays, but finally perineal excision performed Dec. 14, 1943. Pathological examination : Growth confined to inner part of rectal wall, no lymphatic metastases (Stage I) ; of average grade malignancy. Died of bronchopneumonia two months later.

Case 3.—R. D., male, aged 46. Sept. 10, 1937 : Hartmann's operation for carcinoma of rectosigmoid. Pathologically, tumour spread to perirectal tissues, but no lymphatic metastases ; of average grade malignancy. 1½ in. of normal bowel beyond growth. No polyps.

On Jan. 28, 1938, recurrence was detected high up in rectal stump ; positive biopsy. Considered unsuitable for further surgical treatment. April 15, 1938 : Re-admitted with acute intestinal obstruction and emergency laparotomy performed. Loop of small intestine firmly adherent to growth in pelvis ; lateral entero-anastomosis done to short-circuit obstruction ; died on April 19. Autopsy : Extensive recurrence of carcinoma in and around top of rectal stump ; growth of average grade malignancy ; no glands ; liver free.

Case 4.—J. D., male, aged 66. March 10, 1945 : Hartmann's operation for rectosigmoid carcinoma of average grade malignancy extending outside bowel wall ; one metastasis. 4 in. margin of clearance obtained at lower end of specimen, but on this portion of rectum large villous papilloma present (*Fig.* 283).

Feb. 7, 1947 : Small flat semi-ulcerated tumour ¾ in. in diameter on posterior wall of ampulla 2 in. above mucocutaneous junction, 1 in. from upper end of stump.

FIG. 284.—Fresh primary tumour which appeared one year and eleven months later on posterior wall of rectal stump 1 in. from upper end : removed by perineal excision. (*Case* 4.)

Perineal excision (*Fig.* 284) ; growth confined to rectal wall ; of average grade malignancy.

Patient died of a myelitis in America on Jan. 8, 1948—nearly one year later ; no autopsy obtained.

Case 5.—Mrs. R. P., aged 52. Aug. 22, 1947 : Extended Hartmann's operation for carcinoma of middle

third (and to promote better drainage of pelvis through anal canal, sphincters divided in midline posteriorly). Specimen showed growth of colloid type extending through rectal wall to slight extent only; four lymph-glands involved of fifteen examined (Stage III case) (*Fig.* 285). 1 in. of normal bowel beyond lower edge of growth.

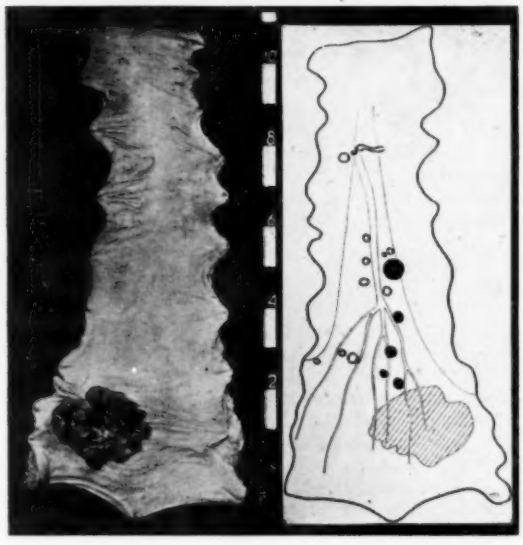


FIG. 285.—First operation specimen removed by extended Hartmann's operation, showing carcinoma 1 in. from distal end accompanied by four lymphatic metastases. (*Case* 5.)

Convalescence slow, and continued to discharge pus through anus even after leaving ward. Much granulation tissue formed in vertical wound in posterior wall of anal canal; biopsy on Feb. 12, 1948, showed adenocarcinoma; perineal excision. Specimen showed mass of colloid carcinoma at upper end of rectal remnant and extending downwards as tongue along line of division of anal sphincters in midline posteriorly, as far as mucocutaneous junction (*Fig.* 286).

She subsequently developed signs of further recurrence in pelvis and died six months later.

Case 6.—S. P., male, aged 53. July 30, 1937: Hartmann's operation for carcinoma of rectosigmoid. Pathological examination showed annular growth of average grade malignancy 2 in. from lower end of specimen and invading perirectal tissues extensively; no lymphatic metastases.

Two years and nine months later patient died in another hospital with apparently extensive local recurrence in pelvis and secondary deposits in lungs; unfortunately no autopsy obtained.

Case 7.—Mrs. M. C., aged 38. Dec. 3, 1938: Abdomino-anal excision for carcinoma of upper third. Specimen showed adenocarcinoma of average grade malignancy, spreading through rectal wall; one glandular metastasis; 2½ in. of normal bowel distal to growth.

June 12, 1940: Ulcerating carcinoma on posterior part of bowel suture line and also behind rectum; biopsy positive. Deep X-ray therapy given and finally on March 26, 1941, further laparotomy carried out, but growth in pelvis too fixed to be excised; hepatic metastases present; iliac colostomy established.

Condition deteriorated post-operatively; died Dec. 9, 1941.

Case 8.—Mrs. A. B., aged 47. May 19, 1939: Abdomino-anal excision for carcinoma of upper third. Pathologically of average grade malignancy and extending through bowel wall; one pararectal lymph-glandular metastasis. 1½ in. margin of clearance distal to growth.

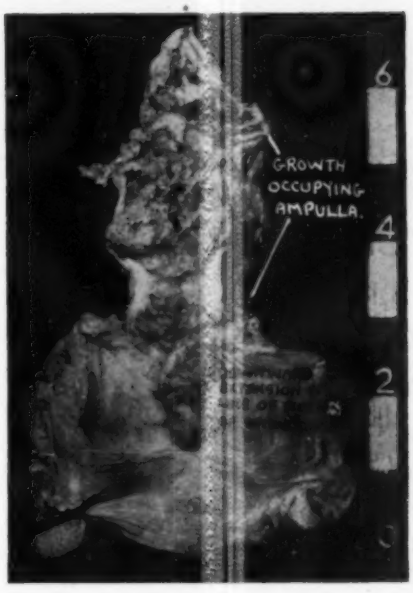


FIG. 286.—Second operation specimen removed by perineal excision six months later, showing carcinoma in ampulla and downward extension in line of division of sphincters. (*Case* 5.)

Jan. 7, 1942: Hard nodule discovered in recto-vaginal septum and extending into left labium. Considered unsuitable for further excision, deep X-ray therapy given. April 1, 1942: Right inguinal glands enlarged; biopsy: positive. Died Feb. 10, 1943, of generalized secondaries.

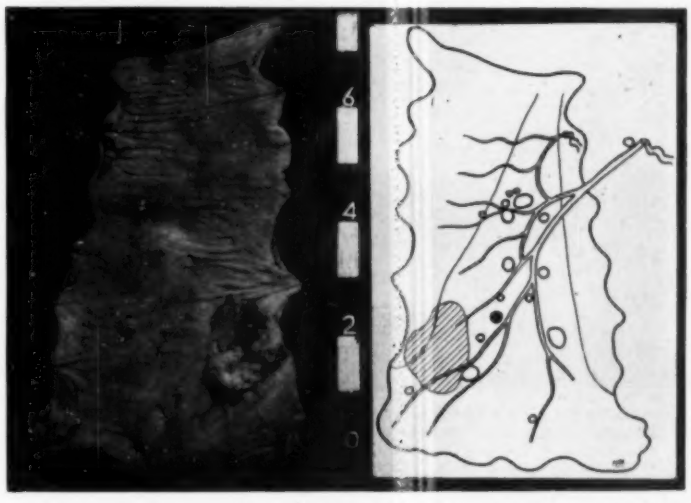


FIG. 287.—First operation specimen removed by abdomino-anal excision, showing carcinoma of ampullary region of rectum with one lymphatic metastasis. (*Case* 10.)

Case 9.—Mrs. A. S., aged 42. July 8, 1939: Abdomino-anal excision for carcinoma of middle third. Confined to rectal wall, no lymph-glands involved; distal edge of specimen only ¼ in. from lower margin of growth.

Dec. 2, 1945: Ulcerated growth discovered on posterior aspect of bowel suture line and extending into presacral space; biopsy showed adenocarcinoma of average grade malignancy. Condition not deemed suitable for further surgery; died in April, 1947.

Case 10.—Mrs. A. W., aged 47. March 1, 1944: Abdomino-anal excision for carcinoma of middle third.

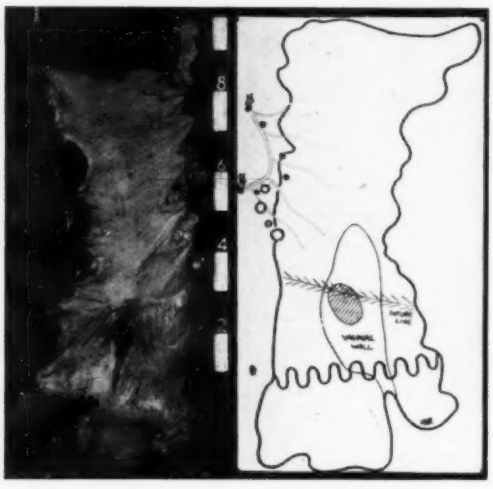


FIG. 288.—Second operation specimen removed by abdomino-perineal excision three years and ten months later for recurrence on suture line and in rectovaginal septum. (*Case* 10.)

Specimen showed carcinoma of average grade malignancy spreading to perirectal tissues; one glandular metastasis (*Fig.* 287). A 1 in. margin of normal bowel separated growth from lower end of specimen.

Jan. 28, 1948: Ulcerating nodule on anterior rectal wall abutting on bowel suture line; biopsy showed adenocarcinoma of average grade malignancy.

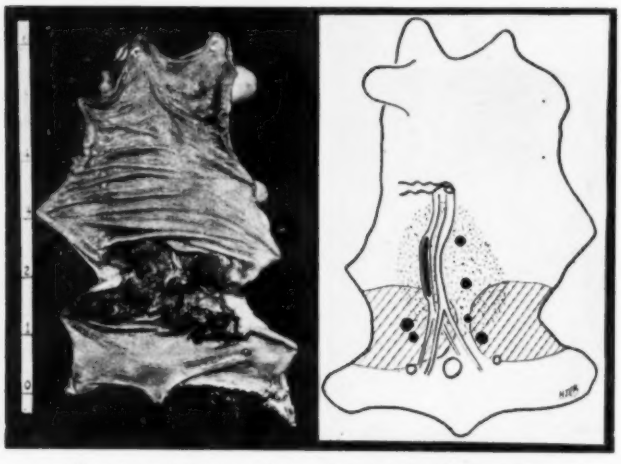


FIG. 289.—First operation specimen removed by anterior resection, showing large carcinoma in upper third of rectum which had spread widely in perirectal fat, permeated a hæmorrhoidal vein and given rise to six lymphatic metastases. (*Case* 13.)

Abdomino-perineal excision with removal of posterior vaginal wall on Feb. 16; growth involved recto-vaginal septum as well as rectal wall; no lymph-glandular metastases (*Fig.* 288).

Patient alive and well on Sept. 20, 1950.

Case 11.—Mrs. E. R., aged 51. Aug. 25, 1936: Abdomino-anal excision of carcinoma of upper third. Operative specimen showed growth penetrating rectal wall, there being also an isolated deposit of carcinoma in the perirectal fat 1½ in. below main tumour and ¾ in. from lower end of specimen. Superior hæmorrhoidal vein contained growth, but no lymphatic gland metastases.

Nov. 2: Re-admitted with suprapubic swelling which clinically appeared to be a recurrence. Nov. 21: Laparotomy showed extensive secondary deposits in pelvic peritoneum and liver; died on Dec. 10.

Case 12.—Mrs. A. W., aged 42. Sept. 19, 1936: Abdomino-anal excision of carcinoma of middle third. Pathologically growth extended through rectal wall into perirectal tissues; deposits in four glands.

March 4, 1937: Recurrence in bowel above suture line and in presacral space. March 10: Died; post-mortem—extensive carcinoma in front of sacrum and on left side of pelvis obstructing left ureter, liver free.

Case 13.—Miss A. B., aged 52. Aug. 22, 1936: Anterior resection for carcinoma of upper third. Specimen showed growth had spread extensively through rectal wall; numerous lymphatic metastases (*Fig.* 289); of low-grade malignancy. 1½ in. margin of normal bowel separated growth from lower edge of specimen.

Three and a half months later was found to have carcinomatous ulcer on bowel suture line posteriorly. Jan. 21, 1937: Abdomino-perineal excision performed with considerable difficulty. Pathologically growth involved extrarectal tissues extensively; many metastases in lymph-glands (*Fig.* 290); of low-grade malignancy. June 12: died.

Case 14.—A. D., aged 68. Nov. 13, 1946: Palliative anterior resection for carcinoma of upper third; liver metastases present. Growth of average grade malignancy

FIG. 290.—Second operation specimen removed by abdomino-perineal excision, showing recurrence on line of anastomosis three and a half months later. (*Case* 13.)

and extended through rectal wall; numerous deposits in glands (*Fig.* 291).

Eleven months later was found to have annular ulcerating growth at suture line in bowel, and also hard nodule in line of old paramedian wound in anterior abdominal wall. Abdomino-perineal excision on Oct. 31, 1937, great difficulty being experienced in separating bowel from sacrum at site of growth. Specimen

showed that neoplasm was adenocarcinoma of average grade malignancy extending widely in perirectal tissues; lymph-glandular metastases (*Fig.* 292). The nodule in

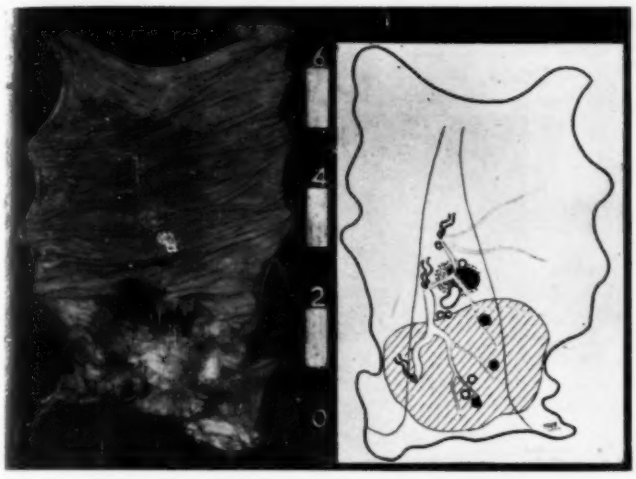


FIG. 291.—Palliative anterior resection for carcinoma of upper third of rectum accompanied by both hepatic and lymphatic metastases. (*Case* 14.)

anterior abdominal parietes also excised and found to be a deposit of carcinoma.

Died on Nov. 24, 1948, apparently of local recurrence.

Case 15.—Mrs. E. C., aged 51. June 28, 1948: Anterior resection of rectum and an adherent loop of ileum, and a Wertheim hysterectomy for carcinoma of upper third of rectum invading uterus and small gut; rectum unfortunately torn during excision. Growth

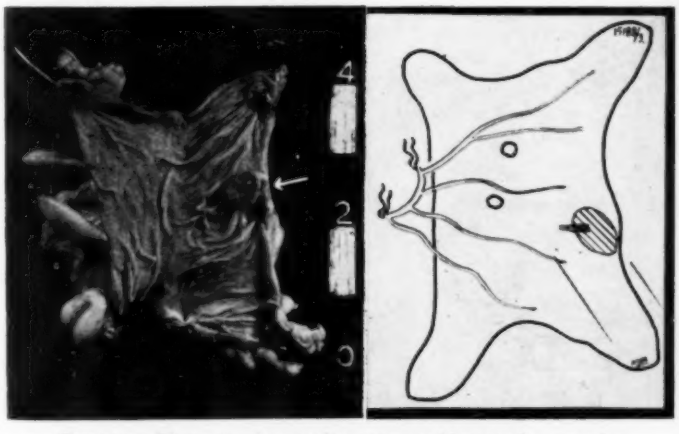


FIG. 293.—First operation specimen removed by anterior resection, showing small protuberant carcinoma (marked by arrow). No pericolic spread and no lymphatic metastases. (*Case* 16.)

was adenocarcinoma of average grade malignancy which had extended widely into perirectal fat and invaded uterus. 2½ in. margin of normal bowel present at lower end of specimen.

Ten months later was found on routine examination to have ulcerating growth on bowel suture line posteriorly. At laparotomy on June 12, 1949, seedling deposits in pelvic peritoneum and growth on left wall of pelvis obstructing left ureter and connecting with growth felt pre-operatively in bowel; combined excision carried out but growth not completely removed. Specimen showed adenocarcinoma of average grade malignancy; no glandular metastases. Died on Sept. 24.

Case 16.—M. B., male, aged 56. Aug. 22, 1949: Anterior resection for growth of lower sigmoid colon. Specimen (*Fig.* 293) contained adenocarcinoma of average

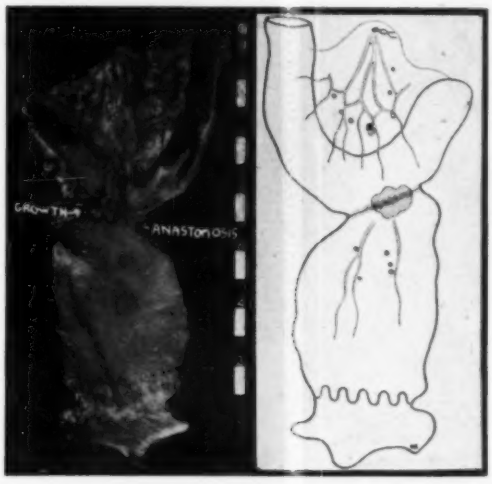


FIG. 292.—Second operation specimen removed by abdomino-perineal excision, showing annular ulcerating growth on suture line eleven months later. (This patient also had a nodule of growth in the anterior abdominal wound.) (*Case* 14.)

grade malignancy confined to substance of colon wall and not invading pericolic fat. Resection restricted in extent but 1½ in. of normal bowel distal and 1 in. proximal to growth; no polyps.

Approximately one year later patient had further symptoms. Sigmoidoscopy showed growth close to line

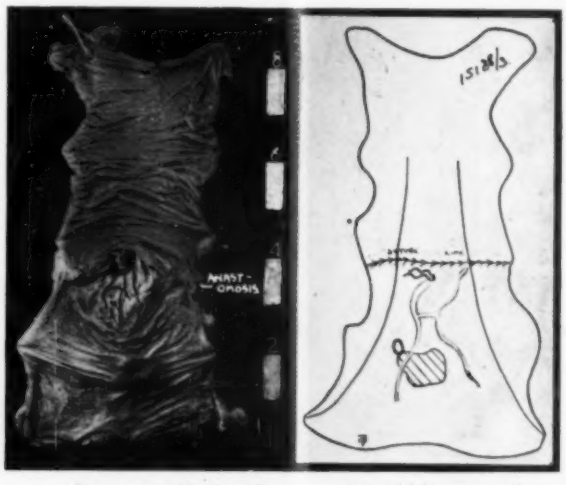


FIG. 294.—Fresh primary tumour which appeared one year after anterior resection. The new tumour arose 1½ in. proximal to the previous anastomosis. (*Case* 16.)

of previous anastomosis. Aug. 28, 1950: Abdominal resection removing affected portion of bowel and restoring continuity by end-to-end anastomosis. Specimen showed small adenocarcinoma 1½ in. proximal to old suture line, which was perfectly healed; had not spread beyond bowel wall or caused lymphatic metastases; no polyps (*Fig.* 294).

Patient alive and well on April 8, 1951.

Case 17.—Mrs. P. F., aged 70. May 20, 1947: Extended Hartmann's operation for carcinoma of posterior and lateral walls of middle third, by Mr. E. T. C. Milligan, at Weir Hospital, Balham. Growth of average

grade malignancy, invading perirectal tissues to slight extent and causing one lymphatic metastasis, as shown in *Fig.* 295. 2 in. of normal bowel present beyond growth.

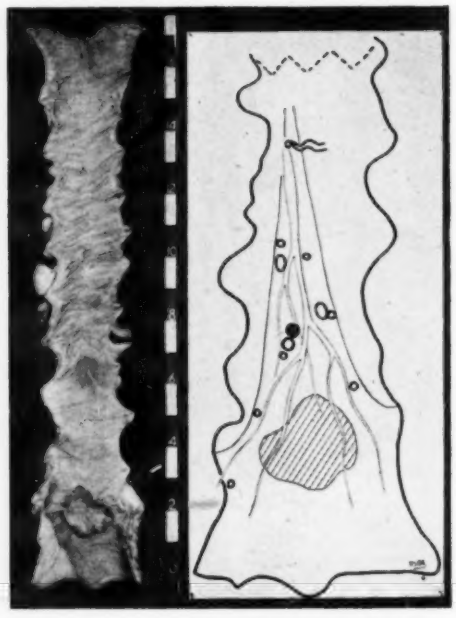


FIG. 295.—First operation specimen (extended Hartmann) showing carcinoma in middle third of rectum accompanied by one lymphatic metastasis. (*Case* 17.)

Six months later carcinomatous ulcer discovered in skin-lined part of posterior wall of anal canal. Perineal excision performed. Growth was adenocarcinoma of

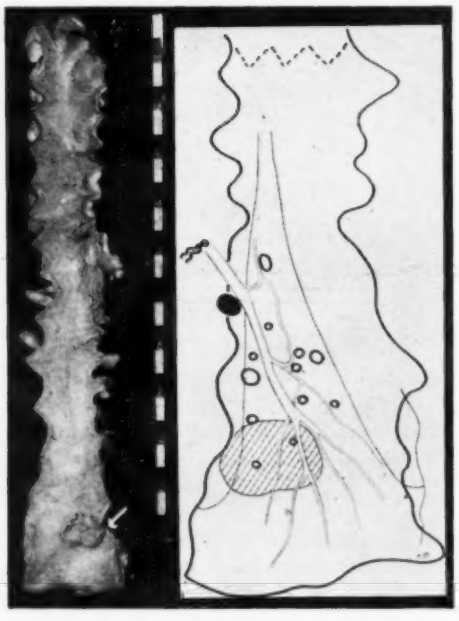


FIG. 297.—First operation (Hartmann) for carcinoma of upper third of rectum with one lymphatic metastasis. (*Case* 18.)

average malignancy which had ulcerated into anal canal and also infiltrated perirectal tissues immediately behind anal canal and lower rectum; no lymph-glandular metastases (*Fig.* 296).

Patient died in February, 1949, from generalized carcinoma.

Case 18.—Mrs. M. A., aged 67. July 23, 1947: Hartmann's operation for upper third rectal carcinoma by Mr. E. T. C. Milligan, at Croydon General Hospital. Specimen showed ulcerating growth on posterior and left lateral walls just above level of peritoneal reflection; had extended into perirectal tissues to moderate extent; only one of nineteen glands contained growth (*Fig.* 297). Margin of clearance below growth 2½ in.

FIG. 296.—Second operation specimen (perineal excision) six months later for recurrence in anal canal. (*Case* 17.)

Six months later hard swelling felt in rectovaginal septum near upper end of small rectal stump, and perineal excision of rectum and posterior vaginal wall performed. Nodule in rectovaginal septum found to be adenocarcinoma of average grade malignancy; it lay ⅝ in. from upper edge of rectal remnant and had caused puckering of overlying rectal mucosa, but had not invaded either

FIG. 298.—Second operation (perineal excision) for recurrence in rectovaginal septum six months later. (*Case* 18.)

vaginal or rectal mucosa (*Fig.* 298); only one lymph-gland involved.

Patient alive and well on April 5, 1951.

Case 19.—W. K., male, aged 53. Sept. 26, 1947: Anterior resection by Mr. J. C. Goligher, at St. Mary's

Hospital, for carcinoma of upper third. Growth of average grade malignancy; had spread through rectal wall and produced glandular metastases. 1½ in. of normal bowel at lower end of specimen.

One year later was found to have annular ulcer on suture line in bowel. Aug. 31, 1948: Synchronous combined excision, growth being separated with some difficulty subsequently has remained well. Pathologically carcinoma extended from bowel wall into perirectal tissues. One glandular metastasis; seven glands examined. Recently re-examined; no signs of recurrence.

Case 20.—Mrs. W. B., aged 46. Jan. 24, 1947: Anterior resection for carcinoma of middle third by Mr. J. C. Goligher, at St. Mary's Hospital. Growth was well-differentiated papilliferous adenocarcinoma apparently confined to wall of rectum but specimen not systematically dissected. At least 1 in. of normal bowel present distal to growth.

Two years later hard mass felt on rectal examination on left side of pelvis, the bowel wall itself being normal and suture line well healed. Abdomino-perineal excision performed on Aug. 30, 1949, with very great difficulty, growth being adherent to sacrum posteriorly as well as to left side of pelvis. Pathologically recurrence was adenocarcinoma of average grade malignancy growing in extrarectal fat and substance of levator muscle; no glands involved.

Subsequently her perineal wound failed to heal and filled with growth. Jan. 5, 1950: Died.

Case 21.—Mrs. A. B., aged 57. June 12, 1946: Anterior resection by Mr. E. G. Muir, at King's College Hospital, for carcinoma of upper third. No pathological details available other than that it was a well-differentiated adenocarcinoma.

Recurrence developed at suture line and abdomino-perineal excision carried out on June 23, 1948. Specimen showed carcinoma of average grade malignancy on posterior part of line of anastomosis between colon and rectum; confined to bowel wall; perirectal tissues and lymphatics uninvolved (Stage I growth).

Patient last seen in February, 1951, when she had obvious abdominal and pelvic secondaries and was going downhill.

Case 22.—Mrs. N. M., aged 51. Feb. 19, 1949: Anterior resection for carcinoma of rectosigmoid. Histologically well-differentiated adenocarcinoma, but no further details available regarding extent of spread.

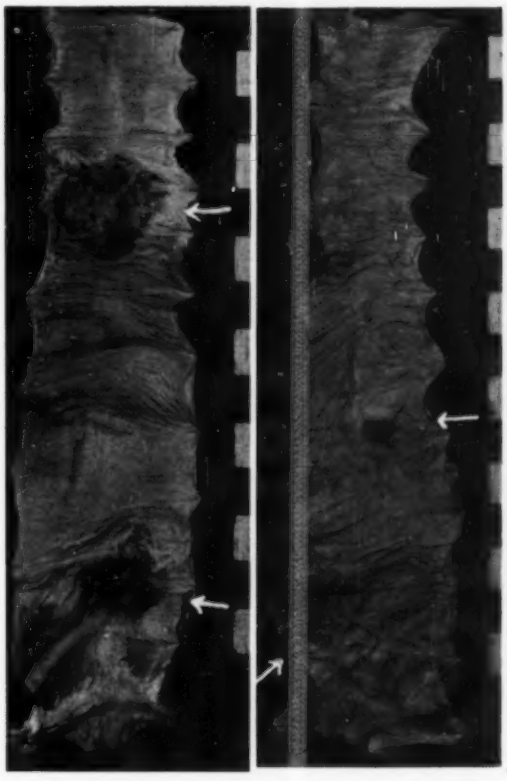
Seven months later patient consulted Mr. Gabriel, who found a carcinomatous ulcer on posterior part of suture line. Oct. 8: Perineo-abdominal excision by Mr. W. B. Gabriel, at Royal Northern Hospital. Growth was adenocarcinoma of average grade malignancy, spreading into perirectal fat to slight extent; no lymphatic metastases (Stage II growth).

Case 23.—Mrs. G. C., aged 61. June 14, 1948: Anterior resection for carcinoma of lower sigmoid. No pathological details available.

Two years and three months later recurrence detected on posterior wall of rectal ampulla. Abdomino-perineal excision on Sept. 14, 1950. Pathologically growth found to be of low-grade malignancy on posterior wall, upper edge abutting on previous suture line in bowel (Stage II growth).

DISCUSSION

We have given a detailed description of these 23 cases of local recurrence after sphincter-saving excision for carcinoma of the rectum and rectosigmoid and we are now going to consider how they can be explained. In the first place it is well to recall that the word 'recurrence' is applied to any local reappearance of a malignant tumour after its surgical removal, irrespective of whether this is due to the growth of a new primary tumour or is in fact a true recurrence attributable to incomplete removal at the first operation. True recurrences, in the strict sense of the word, may be usefully subdivided into two groups, namely the expected and the unexpected. If we divide our 23 cases into these three groups:



A B

FIG. 299.—Two combined excision specimens showing double carcinomata of the rectum. The growths are indicated by arrows. In specimen A both carcinomata are at approximately the same stage of development, but in specimen B one is obviously of much more recent origin than the other.

(1) new primary tumours; (2) expected recurrences; and (3) unexpected recurrences, we shall be able to focus attention on some points which we consider to be of special surgical importance.

1. NEW PRIMARY TUMOURS

It is well known that two or more carcinomata may develop simultaneously in different parts of the large bowel. Thus in a series of 3220 specimens of cancer of the rectum and colon examined in the Pathology Department at St. Mark's Hospital from 1928 to 1948 inclusive, there were 98 examples of multiple malignancy, an incidence of just over 3 per cent. Sometimes the growths present in these cases were of roughly the same extent and had apparently arisen more or less simultaneously, as in *Fig.* 299 A, but at other times one tumour was obviously much younger than the other as in *Fig.* 299 B and had developed consecutively. It will readily be appreciated that in the latter cases the chronology of development and location of the

growths might have been such that the older carcinoma could have been detected and removed surgically before the other had appeared or was sufficiently large to be detected by the surgeon at laparotomy. It would then show itself in the remaining portion of colon or rectum at a later date, as in the cases observed by Norbury (1930), Lockhart-Mummery (1930), Westhues (1934), Finsterer (1941), Mayo and Schlicke (1942), and Gilchrist and David (1947). It is difficult to say how often this occurs. In our own follow-up records of cases of rectal carcinoma after excision at St. Mark's Hospital it is probable that further primary carcinomata developing in the large gut have often been misrepresented as recurrences of the original tumour because the final diagnosis is usually made by the general practitioner without the assistance of a laparotomy or the confirmation of an autopsy. However we are at present engaged on an investigation into the precise cause of death in these patients, which will indicate the frequency of recurrences and fresh primary growths.

It appears to us that for some of our apparent recurrences after resection operations there can be no other explanation than that they were consecutive primary carcinomata—we refer to *Cases* 2, 4, and 16 (*see Table I*), where the second growth arose in apparently intact mucosa away from any suture line or line of section, and in *Case* 2 did not reappear till 6½ years after the first operation. These three cases will be excluded from further consideration.

Table I.—SUMMARY OF 23 CASES OF LOCAL RECURRENCE AFTER SPHINCTER-SAVING EXCISIONS FOR CARCINOMATA OF THE RECTUM AND RECTOSIGMOID

Cases	Original Growth				Subsequent Growth			Suggested Mode of Formation
	Site of Growth	Nature of Resection	Stage of Spread	Distal Margin of Normal Bowel	Time of Detection after Operation	Exact Site	Stage of Spread	
1. G. D. H. 40 yr.	Rectosigmoid	Hartmann's operation	I	1 in.	1 yr. 3 mth.	Extreme upper end of rectal stump	III	Probably implantation
2. W. J. M. 66 yr.	Upper third	Hartmann's operation	I	1 in.	6 yr. 5 mth.	Posterior wall of rectal stump just above anorectal ring	I	Fresh primary
3. R. D. 46 yr.	Rectosigmoid	Hartmann's operation	II	1½ in.	4 mth.	In and around upper end of rectal stump	II (possibly III)	Probably implantation
4. J. D. 66 yr.	Rectosigmoid	Hartmann's operation	III	4 in.	1 year 11 mth.	Posterior wall of rectal stump 1 in. from upper end	I	Fresh primary
5. Mrs. R. P. 52 yr.	Middle third	Hartmann's operation (with division of anal sphincters posteriorly)	III	1 in.	6 mth.	Upper end of rectal stump extending down wound in midline posteriorly	II	Probably implantation
6. S. P. 53 yr.	Rectosigmoid	Hartmann's operation	II	2 in.	2 yr. 9 mth.	Apparently in upper end of rectal stump and pelvis. Patient died in another hospital. Also secondaries in lungs alleged. No P.M.	Not determined	Probably implantation
7. Mrs. M. C. 38 yr.	Upper third	Abdomino-anal excision	III	2½ in.	2 yr.	On suture line posteriorly. (Also had liver secondaries.)	Not determined. (Laparotomy and colostomy only.)	Probably implantation
8. Mrs. A. B. 47 yr.	Upper third	Abdomino-anal excision	III	1½ in.	2 yr. 7 mth.	Rectovaginal septum and extending to left labium	Not determined. (No excision or autopsy.)	Probably implantation
9. Mrs. A. S. 42 yr.	Middle third	Abdomino-anal excision	I	¼ in.	6 yr. 5 mth.	Posterior aspect of suture line and presacral space	Not determined. (No excision or autopsy.)	Incomplete removal
10. Mrs. A. W. 47 yr.	Middle third	Abdomino-anal excision	III	1½ in.	3 yr. 10 mth.	Anterior rectal wall abutting on suture line and extending into rectovaginal septum	II	Probably implantation
11. Mrs. E. R. 41 yr.	Upper third	Abdomino-anal excision	II	2¼ in.	6 mth.	In pelvic peritoneum and suprapubic region but not in bowel. (Liver secondaries only.)	Not determined. (No excision or autopsy.)	Probably implantation

2. EXPECTED RECURRENCES

In carrying out the operations described, every effort was made to secure an adequate removal of the tissues of the upward zone of lymphatic extension

by high division of the inferior mesenteric vessels, as in a combined abdomino-perineal excision, and to obtain a margin of clearance below the primary growth of not less than 1 in. of normal bowel, as recommended by Westhues (1934) and Wangansteen (1945). In some of our cases, however, these criteria were unfortunately not entirely satisfied. Thus in 2 of our cases (*Cases* 9 and 14—*see Table I*) the margin in all the other 15 cases (the 3 cases of fresh primary tumour not being included) the original resection specimens showed at least 1 in. of apparently normal rectal wall and mesorectum distal to the growth.

3. UNEXPECTED RECURRENCES

How are these 15 unexpected recurrences to be explained? We recognize of course that in some of the

Table I.—SUMMARY OF 23 CASES OF LOCAL RECURRENCE AFTER SPHINCTER-SAVING EXCISIONS FOR CARCINOMATA OF THE RECTUM AND RECTOSIGMOID, *continued*.

CASES	ORIGINAL GROWTH				SUBSEQUENT GROWTH			SUGGESTED MODE OF FORMATION
	Site of Growth	Nature of Resection	Stage of Spread	Distal Margin of Normal Bowel	Time of Detection after Operation	Exact Site	Stage of Spread	
12. Mrs A. W. 42 yr.	Middle third	Abdomino-anal excision	III	2½ in.	6 mth.	On suture line posteriorly and in sacral wound	Not determined. (No further excision or autopsy)	Probably implantation
13. Miss A. B. 52 yr.	Upper third	Anterior resection	III	1½ in.	3½ mth.	On suture line posteriorly	III	Probably implantation
14. A. D. 68 yr.	Upper third	Anterior resection. (Palliative—liver secondaries)	III	¼ in.	11 mth.	Circumferentially on suture line. (Also nodule in anterior abdominal wound.)	III	Incomplete removal
15. Mrs. E. C. 51 yr.	Upper third	Anterior resection and Wertheim's hysterectomy	II	2½ in.	10 mth.	On suture line posteriorly and retrorectal tissues. Also seedlings in pelvic peritoneum	II	Probably implantation
16. M. B. 56 yr.	Distal sigmoid	Anterior resection	I	1½ in.	1 yr.	In colon wall 1½ in. proximal to previous suture line	I	Fresh primary
17. Mrs. P. F. 70 yr.	Middle third	Extended Hartmann's operation	III	2 in.	6 mth.	Posterior wall of anal canal	II	Probably implantation
18. Mrs. M. A. 67 yr.	Upper third	Hartmann's operation	III	2½ in.	6 mth.	In rectovaginal septum near upper end of rectal stump not ulcerating into bowel or vagina	III	Probably implantation
19. W. K. 53 yr.	Upper third	Anterior resection	III	More than 1 in.	1 yr.	Circumferentially on suture line	III	Probably implantation
20. Mrs. W. B. 46 yr.	Middle third	Anterior resection	I	More than 1 in.	2 yr.	In substance of left levator muscle and extrarectal fat	II	Probably implantation
21. Mrs. A. B. 57 yr.	Upper third	Anterior resection	Not known	Not known	2 yr.	On suture line posteriorly	I	Incomplete removal
22. Mrs. N. M. 51 yr.	Rectosigmoid	Anterior resection	Not known	Not known	7 mth.	Posterior part of suture line	II	Incomplete removal
23. Mrs. G. C. 61 yr.	Lower sigmoid	Anterior resection	Not known	Not known	2 yr. 3 mth.	Posterior wall of rectal ampulla, upper edge abutting on previous suture line in bowel	II	Incomplete removal

of clearance obtained below the growth in the original resection was certainly inadequate, because in each instance, due to faulty judgement at operation, the distal line of section was taken immediately below the lower edge of the growth. We can readily believe that in both of these cases recurrence was due to inadequate excision. It is also possible that in *Cases* 21, 22, and 23, in which the operation specimen was not available to us, an insufficient margin of clearance may have been obtained. But cases there may have been an unusual form of upward or downward spread of the growth in the extramural lymphatics or in the bowel wall which may have accounted for the recurrence in some instances, but we think this is unlikely to be the explanation in most cases because of our experience in the dissection of operation specimens of rectal cancer removed by combined excision. To estimate the probability of downward lymphatic spread we studied the records of the gland dissections in 1500 consecutive specimens

of cancer of the rectum and rectosigmoid removed by combined excision, and found metastatic involvement of the glands below the level of the growth in only 98, or 6·5 per cent of the specimens. Moreover, in 68 of these the glands concerned lay within ½ in. of the lower margin of the growth and would therefore have been removed had there been a clearance of at least 1 in. In the remaining 30, downward spread occurred to a distance of ¾ in. or more below the lower margin of the growth, and had this exceptional form of spread occurred in any of our series of cases it might of course have been responsible for a local recurrence. But we wish to emphasize the fact that such downward lymphatic spread to a distance of ¾ in. or more is a rare phenomenon and has only been recorded in 2 per cent of all cases. Therefore it is unlikely to have been the explanation in more than two or three of our cases treated by resection.

As regards extension in the wall of the rectum or colon beyond the macroscopical edge of the growth, we have observed spread by this method as far as 2 or 3 in. from the primary tumour in a few cases of highly active anaplastic carcinomata. Such anaplastic growths, however, are very rare and in our experience quite incurable by any operation. In carcinomata of average or low-grade malignancy we found that direct spread was always very restricted and that a distal margin of 1 in. of apparently normal bowel beyond the growth would have been adequate in a resection operation. The growth in all our cases that developed recurrences was of average or low-grade malignancy or of colloid type; none was anaplastic.

If we examine our 15 unexpected recurrences more closely there are certain features about them that make it difficult to accept inadequate removal at the first operation as the factor responsible for their development in all the cases:—

1. *The growth in the initial operation specimen* in several of the cases was still in a relatively early stage of development and apparently completely removed by the excision—thus of the 15 cases the original growths in 2 were in Stage I (A cases), in 4 in Stage II (B cases), and in 9 in Stage III (C cases)—that is to say in 6 out of the 15 cases no lymphatic metastases were found in the original specimens and *in 2 the carcinoma was still confined to the rectal wall.*

2. *The recurrence* has usually implicated the bowel wall and produced ulceration of the mucous membrane. In only 4 cases did it develop and remain entirely outside the rectum, being situated in the levator muscle in 1, in the pelvic peritoneum and lower abdomen in another, and in the rectovaginal septum in 2 others. In the remaining 11 cases, however, the recurrence caused ulceration of the bowel mucosa; this was situated at the suture line of the previous anastomosis in 6, in the top end of the blind rectal stump in 4, and in the anal canal some distance from any line of section or suture in 1 (*Case* 17). In most of these ulcerating cases the growth lay partly in the bowel wall and partly outside it, usually posteriorly, and it was impossible to be sure if it had originated in the immediate extra rectal tissues and invaded the bowel secondarily, or vice versa.

Consideration of these facts makes us wonder if recurrence in the ordinary sense of the term is the true explanation of the reappearance of the carcinoma in these cases, and, further, suggests to us that, in at any rate some of the cases, the cause of the 'recurrence' may have been implantation of loose carcinoma cells present in the lumen of the rectum mixed with the fæces at the time of the first operation. In support of this hypothesis we draw attention to the frequency with which the recurrence has arisen where a raw surface was created by the operation, that is at the upper end of the rectal stump in Hartmann's operation or at the suture line in restorative resections. Particularly striking in this respect was *Case* 5, where the anorectal stump was incised at the conclusion of the operation in order to divide the sphincters and promote better drainage of the pelvic cavity; the recurrence in this patient developed in the wound resulting from this incision and at the upper end of the stump (*Fig.* 286). We would point also to the fact that *Case* 14 was complicated by the occurrence of a nodule of growth, confirmed by biopsy, in the paramedian wound in the anterior abdominal wall. Whatever may have been the explanation of the deposit in the region of the bowel anastomosis in this case, the recurrence in the abdominal parietes can only have been due to implantation, which demonstrates beyond doubt that this form of spread is possible with carcinoma of the rectum or colon. Even in the 4 cases (*Cases* 8, 11, 18, and 20) where the recurrence developed and remained entirely in the extrarectal tissues, implantation may still have been the factor responsible because some contamination of the pelvis with bowel contents is not uncommon in these operations, and owing to the extensive mobilization of the anorectal stump generally carried out it would be possible for carcinoma cells to have been deposited in the rectovaginal space, on the levator muscle, or elsewhere in the pelvic cavity or peritoneum.

It would seem, therefore, that there may be a danger of cancer cells, present in the lumen of the bowel below a rectal carcinoma, becoming engrafted on any raw surface with which they are allowed to come in contact. Hitherto, little opportunity has been afforded for the formation of implantation secondaries in this way, because the operations generally employed have been combined excisions or similar amputative procedures in which the entire rectum down to the anus (which has been securely closed beforehand by a purse-string suture) has been removed. It might be argued that after these operations implantation ought sometimes to have occurred at the iliac colostomy, but there is presumably no normal upward passage of carcinoma cells in the lumen of the bowel against the fæcal stream to give rise to deposits in the region of the colostomy in these cases. In a series of over 2000 cases of excision of the rectum at St. Mark's Hospital we have had only 3 instances of recurrence at the colostomy, these being possibly due to implantation of malignant cells displaced upwards into the sigmoid colon during the manipulations at operation. With resections of either Hartmann's or restorative type, however, there is obviously much more scope for the production of metastases by implantation.

It may further be argued that if this form of spread occurs with rectal or rectosigmoid carcinoma, it ought by analogy to take place after resection and anastomosis for growths of the upper colon or stomach, and yet suture line deposits following these operations have not been recorded. This is true, but it certainly does not mean that they do not occur. It must be remembered that most patients who develop recurrence after operation for gastric or colon carcinoma die either at home or in hospitals or incurable cases, and as the cause of their death is evident they are seldom submitted to necropsy, so that our knowledge of the extent and nature of the recurrence is very imperfect. By contrast, recurrences developing in the region of the anastomosis after resection for rectal or rectosigmoid growths are readily detected by means of the sigmoidoscope, which is used regularly in the examination of these patients after operation. *Fig.* 300 illustrates such a recurrence on the suture line following a resection and anastomosis for a carcinoma of the splenic flexure, the recurrence being detected at a subsequent laparotomy for another carcinoma two years after the original operation. *Fig.* 300 shows the anastomotic region which was removed at this second operation. *Fig.* 301 shows two interesting recurrences on the suture line following a subtotal colectomy and side-to-side ileosigmoidostomy for a double carcinoma of the ascending and descending colon: one of the recurrent growths developed in the ileosigmoid anastomosis, the other at the top end of the blind sigmoid stump. The latter was a Stage I growth.

We have endeavoured to approach the problem of the cause of these recurrences with an unbiased mind and we have gradually been forced to the conclusion that in a large number of cases, possibly almost half, the recurrence must be ascribed to implantation of carcinoma cells on a raw surface. If this is the probable explanation of so many of these recurrences we must ask if anything further can be done to lessen the danger of implantation of cancer cells in restorative resections for rectal cancer.

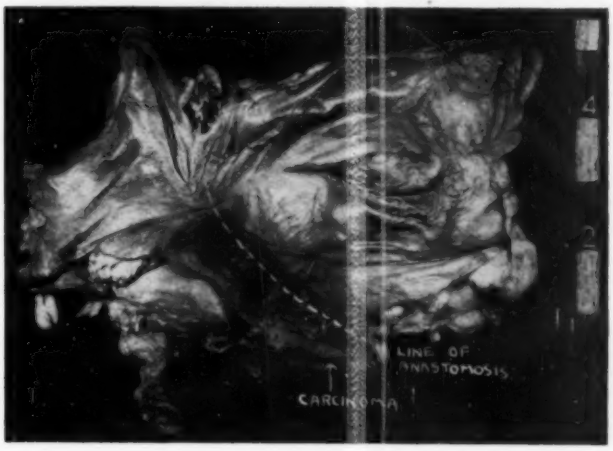
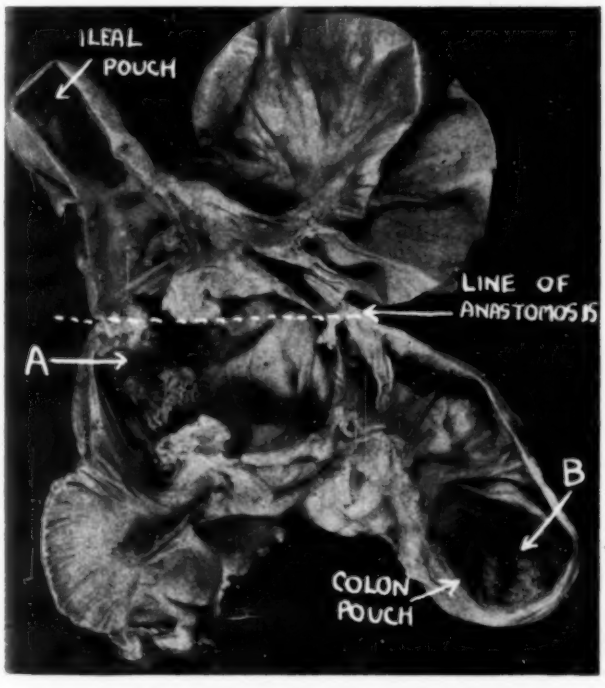


FIG. 300.—Recurrence on suture line following resection of carcinoma of splenic flexure treated by further resection two years later.

The main risk of implantation of carcinoma cells presumably arises from dissemination of bowel contents when the rectum is sectioned below the growth rather than when the colon is divided above it. We have therefore made it our routine in carrying out these operations to wash out this lower part of the rectum per anum immediately before the bowel is severed. To do so satisfactorily at that precise juncture it is essential that the patient should be in the lithotomy-Trendelenburg position, because it alone permits of easy access to the anal region during



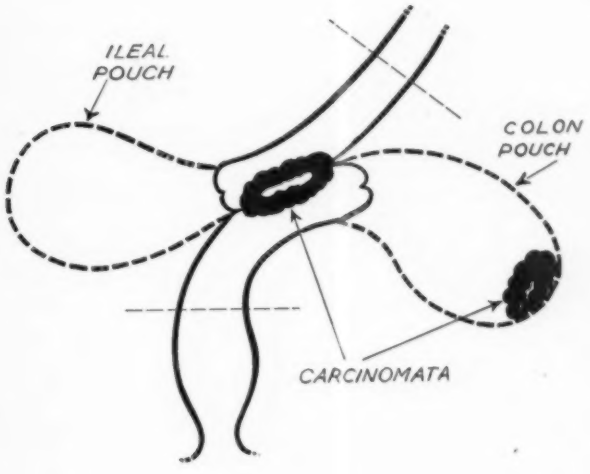
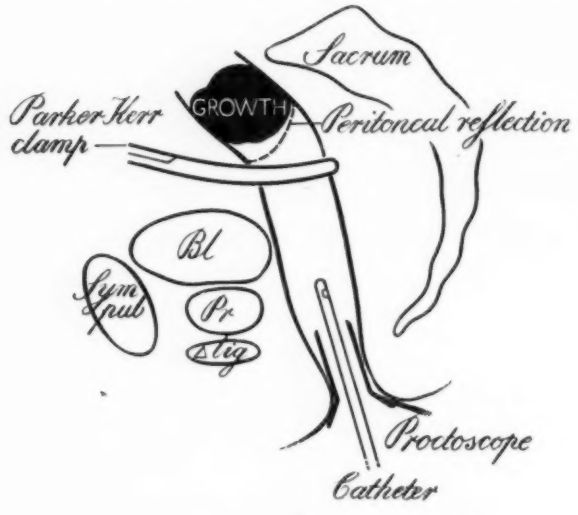


FIG. 301.—This patient had a subtotal colectomy for a carcinoma of the transverse and upper sigmoid colon followed by side-to-side ileosigmoid anastomosis. Three years later she developed a recurrence in the region of the anastomosis. This was resected and end-to-end ileorectal anastomosis performed, the second operation specimen being shown above. Note the dilatation of the blind ends of bowel and the two recurrences, one on the actual anastomosis and the other at the top end of the sigmoid stump.

an abdominal dissection. The procedure is to apply a crushing clamp to the rectum 1 in. below the growth to prevent the descent of any further fæcal matter or discharge which might contain cancer cells. An assistant then passes a proctoscope and irrigates the rectum below the clamp (*Fig.* 302 A). The solution used is 1/500 perchloride of mercury, which may have the additional advantage of being a protoplasmic poison lethal to loose malignant cells. The irrigation is usually continued for five minutes, and the rectum is then divided by the abdominal operator ¾–1 in. distal to the clamp, as in *Fig.* 302 B.



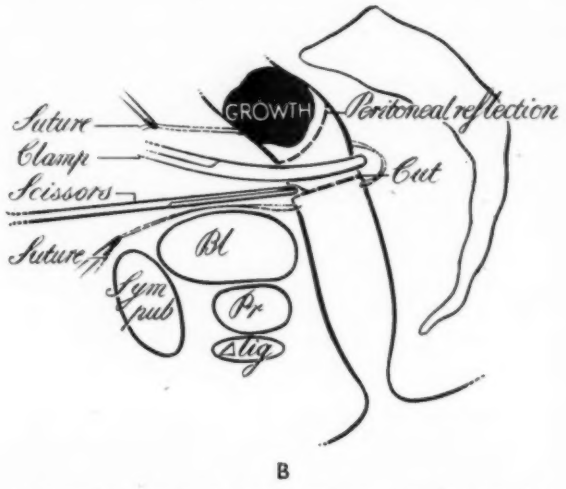


FIG. 302.—Method of cleansing and dividing rectal stump in anterior resection operation for rectal carcinoma. A, The bowel is clamped with curved Parker Kerr crushing clamp approximately 1 in. below the growth to prevent further descent of fæces and possible carcinoma cells; a proctoscope is then passed per anum and the rectum below the clamp irrigated with 1/500 perchloride of mercury solution for five minutes. B, The bowel is then divided with scissors ½ in. or more below the clamp.

It is unfortunately impossible to conduct any simple lavage of the interior of the sigmoid colon prior to its division, but perhaps the danger of implantation here is in any case much less. We simply swab the mucosa and cut edge of the sigmoid stump with a perchloride of mercury solution prior to anastomosis.

We have been taking these special precautions against implantation during resection operations since the latter part of 1947, and it will be observed that most of our recurrences arose in patients treated before that date, though the majority of our series of resection operations have been performed since. In fact only 2 recurrences have been encountered in this latter part of our series—*Case* 15, where the rectum was unfortunately torn during the operation before irrigation had been carried out, with some contamination of the pelvis; and *Case* 16, where the recurrence may well have been due to inadequate excision or to the development of a fresh primary carcinoma.

We should mention also that having been impressed during the earlier part of our series of resection operations by the difficulty of judging accurately at laparotomy the position of the lower edge of the primary growth, we came to the conclusion that it was always safer to aim for a lower margin of clearance of 2 in. rather than 1 in. in the resection specimen to allow for any errors of assessment. Since early in 1948 there have been practically no cases where the lower line of section of the rectum has been too close to the primary growth. This fact may also have played a part in achieving the apparent reduction in the incidence of recurrence.

SUMMARY

In this paper we have given details of 23 cases of 'recurrence' following restorative resections. Some of these we think were really fresh primary tumours, others were true recurrences due to incomplete removal at the first operation, but in possibly half the cases we think that the so-called recurrences may have been due to surgical implantation at the first operation. We admit that the evidence for this is not completely conclusive, but we think it is sufficient to justify additional precautions against the danger of implantation of cancer cells, especially on a raw surface. Since the adoption of such measures and also the exercise of greater care to ensure an adequate excision of the growth at the first operation, the incidence of recurrences in our experience has markedly diminished, but this may be purely fortuitous and transient, and more prolonged observation is clearly required to define accurately the risks of recurrence after sphincter-saving resections.

RECURRENT VERSUS NEW AND INDEPENDENT CARCINOMAS OF THE COLON AND RECTUM

Since the completion of our paper our attention has been drawn to the thesis submitted by Long, Mayo, Dockerty, and Judd (1950) in which it is suggested that 'recurrent' can be distinguished from 'new and independent carcinomas' of the colon and rectum on the basis of the histological appearance at the margin of the malignant growth. These authors state that in recurrent growths there is no transition zone between carcinoma and normal mucosa, whereas this was observed in the cases

classified by them as 'new and independent carcinomas'. We admit that if such a 'transition zone' were present this would be evidence in support of the tumour being a 'new and independent carcinoma', but in many obvious primary carcinomas no 'transition zone' can be detected. Therefore, although a closer study of the histology of the edge of a tumour may provide valuable information in some cases, it is unsafe to rely on this alone when attempting to distinguish between primary and secondary tumours.

We wish to record our thanks to our colleagues at St. Mark's Hospital, and to Mr. E. G. Muir, for kind permission to include their cases in this survey.

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A CONTRIBUTION TO THE PRINCIPLES OF THE SURGERY OF INGUINAL HERNIA

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"If there is no good reason for change, there is a good reason for no change."

CONCERNING the problem of inguinal hernia and its morbid and living anatomy, a thesis is presented suggesting the use of Astley Cooper's ligament as the keystone of repair in this type of hernia and the abandonment of the use of Poupart's ligament in this sense. This principle was applied to a series of 116 adult male herniæ in 1948–9.

THE PROBLEM

The surgeon's battle with inguinal hernia still goes on, and not only the surgeon but the anatomist also is concerned. A century ago he would have been one and the same person, for anatomy was so vital to the operating surgeon of those days, his craft depending very largely upon it. To-day, not only must he have a knowledge of structural anatomy, but also of functional anatomy, added to which is the modern need for an understanding of biochemistry and physiology.

The history of the operative procedures for hernia was reviewed by Edwards (1943), and it is enough for me to point out that prior to Halsted, Marey, and Bassini, the method of repair was usually that of simple ligation of the sac at the external ring. Bassini's great contribution was the exposure, by careful dissection, of the whole length of the inguinal canal and ligation of the sac at the internal ring, and he also introduced a repair manœuvre planned to prevent recurrences. These still followed, though to-day it is often claimed that in good hands the number is no more than after other types of repair (approximately 10 per cent). It is not often realized that Bassini also stressed the importance of repair of the transversalis fascia medial to the internal ring. Bassini has, from time to time, come in for much unfair criticism, whilst the other two workers mentioned have escaped for the most part. Although Bassini's name is used frequently in this paper it is merely in order to avoid misunderstanding which might arise if reference was made to Halsted or Marey.

Why did Bassini choose this type of repair? It seemed to be founded either upon a supposed anatomical truth concerning the posterior wall of the inguinal canal and the insertion of the conjoined muscle and tendon, or on the fact that the muscle and Poupart's ligament presented themselves as suitable structures for apposition (Halsted). Although the direct suturing of these two structures has been criticized and largely abandoned in the operations of inguinal herniorrhaphy and herniorplasty of to-day, these operations are almost always variations of this principle; for flaps and fascia, slides, skin, and steel wire still use the inguinal ligament as a basis for the operation to prevent direct recurrence, after attention has been directed to the internal ring to prevent indirect recurrence.

It was the direct hernia and the direct type of recurrence that aroused first interest, for the full understanding of the normal and abnormal anatomy of this region with a workable operative plan for the herniæ, has been and still is the hernia bogy. Five

years were to elapse before it was possible to put personal interpretations of standard knowledge to the practical test.

To start with, I was uncertain as to the frequency with which the recurrent herniæ with a direct sac is met. My impression was that it was greater than the recurrence with an indirect sac, but impressions can deceive, and in this case it may be because the great weakness of the posterior inguinal wall, the size of the recurrence, and the intricate repair creates just such an impression that the actual number of indirect types encountered tended to be forgotten.

In 131 cases of recurrence, Edwards and Capper (Edwards, 1943) found 98 indirect and 33 direct sacs, a proportion of 3 to 1 in favour of indirect recurrence. Leigh Watson (1932), in his book on hernia, quotes Burian as reporting 62 recurrences following the Bassini operation, of which 25 were indirect and 37 direct, a proportion of 7 to 5 in favour of direct recurrence. Rather similar proportions have been quoted by other authors. Here there are contradictory figures; and instead of discussing whether military age is responsible for the first set it would seem more relevant to ask whether either series can be accurate, especially if the differentiating factor as between indirect and direct sac is often allowed to be the inferior epigastric artery. The time has come when this vessel should be accorded no more significance in the surgery of the region. The direct recurrence may be a bulge lateral as well as medial to the artery, which is so easily displaced inwards. This lateral bulge is truly a bulge of the posterior wall. The indirect recurrence nearly always occurs in its original relationship to the cord, the sac giving the false appearance of not having been removed, or merely having been tied at its neck. In any case, to the patient, the appearance of a swelling in the groin after an operation for inguinal hernia is a recurrence: and if we are to decide what is or is not a recurrence for the purpose of gauging the success of a particular operation, we might let the patient do it. The swelling of which he complains may of course be a femoral hernia occurring after an indirect inguinal operation, and statistically it would be classified as a femoral hernia pure and simple instead of a recurrent inguinal hernia. I think that, anatomically speaking, recurrences may be separated into 'true' and 'false'. For instance, if an indirect sac follows upon operation for indirect hernia, it is a true anatomical recurrence as opposed to a false one in which a direct sac or femoral hernia appears. Conversely, if the operation was for a direct hernia in the first place, a direct recurrence would be a true, and an indirect (? the missed sac) a false anatomical recurrence. This may sound theoretical, but I feel it has practical value.

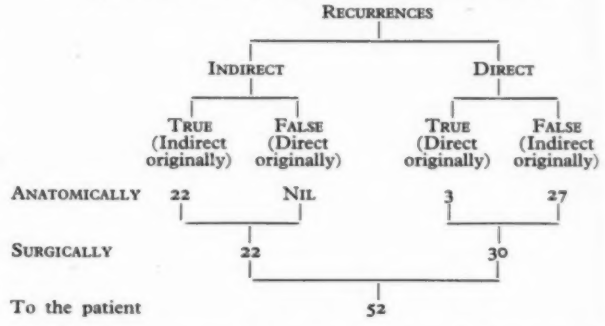
I examined the case notes of 500 inguinal hernia operations performed in 1948 and 1949 at the Birmingham United Hospital and at Bedford County Hospital, and, in all, 52 recurrences were operated on. There were 22 indirect, and 20 direct recurrences, and 10 in which doubt was entertained, in some cases due to the occurrence of a pantaloon or saddle-bag type of sac. I think these 10 should be regarded as direct recurrences as they occurred through the weak posterior wall of the canal medial to the internal ring.

For what it is worth I have analysed these 52 recurrences in *Table I.*

I intended at first to leave aside the problem of indirect recurrence, accepting all that had been said about perfect dissection, clean herniotomy, and the 'transversalis stitch'; but it will intrude automatically, and I hope, with its solution.

What are the problems of the direct recurrence? In the case of the 27 false direct recurrences in the

Table I.—Analysis of 52 Cases of Recurrence*



above table, preventative steps had or had not been taken at the original operations depending upon the muscular state at that time. It is the merits of these steps (doing nothing, herniorrhapy, hernioplasty) using different sewing materials that are usually examined in papers on hernia repair. In this number of recurrences, details of the original operations were lacking for the most part, as they have been performed many years previously and elsewhere.

Surely the problem of direct recurrence goes with the problem of the direct hernia, and therefore further understanding of the transversalis fascia is called for through which these protrusions arise, and is not this the same problem as that of the femoral hernia which primarily protrudes through the same fascia?

If this is so, why is it that the Bassini scaffolding, the inguinal ligament, has been used for the special repair to prevent direct recurrence when Lotheisen introduced an equally sound, or sounder operation, for this similar primary protrusion, the femoral hernia, the only real difference in the repairs being the scaffolding. It is extremely interesting to note that the first time Lotheisen used his special repair for femoral hernia was in a woman who previously had had two unsuccessful operations for inguinal hernia by the Bassini method, and it was the success of the operation that stimulated its use for a series of cases of hernia.

It was the advocacy by R. M. Handfield-Jones in his general surgical teaching of the use of this Lotheisen manœuvre, or may I call it Astley Cooper repair, in the operation for direct hernia that prompted this anatomical and practical surgical investigation, though I later learned that Babcock (1927) and Heritage (1943) had employed it, and

* In at least ten cases, the type of the original hernia is not known. For reasons of age at the time of the primary operation they have been regarded as indirect herniæ. Although indirect and direct recurrence figures are as accurate as possible, the division into true and false is more by way of being demonstrative.

Anson and McVay (1942) recommended it for the same purpose.

However, I wished to find all the grounds possible upon which to use Astley Cooper's ligament as the basis for any repair of inguinal hernia, and to abandon the inguinal ligament. It seemed necessary, first of all, to turn back the pages of the history of surgical anatomy.

ANATOMY OF THE REGION

The Evidence of Descriptive Anatomy.—At the beginning of the nineteenth century, Sir Astley Paston Cooper published a collection of his lectures on the inguinal region and on inguinal, femoral, and other herniæ. The first edition appeared in 1807 and a second in 1827, and the anatomy of the region is described in parts one and two of each edition. Difficulty may be encountered by the student of this subject on the grounds of terminology and topographical nomenclature, but after repeated readings with projection into our present-day terminology fuller understanding is attained. On the whole it is fair to say that the accuracy of his descriptions has rarely been surpassed, and it has taken over a hundred years to see such descriptions confirmed and extended, in the light of recent studies by Anson and McVay. Astley Cooper's accurate descriptions most probably led to the orthodox teaching of the anatomy of the region, though through the passage of years and text-books, and as a result of change in the nomenclature, inadequate and occasionally incomprehensible writings were bound to occur. To those who are interested in the problem of herniæ a study of Astley Cooper's work along with that of Anson and McVay is of vital importance. I should like to quote appropriate sections from Astley Cooper :—

"The direct passage of the spermatic cord into the cavity of the abdomen is prevented by tendons and fascia, which are probably intended as a guard against the protrusion of the contents of the belly, and the tendons that close the opening are those of the internal oblique and the transversalis muscle. Behind the tendon of the external oblique the lower fibres of the internal oblique take their course—those from the spine of the ilium horizontally towards the linea semilunaris and alba, while those which arise from the outer half of Poupart's ligament are passing obliquely towards the pubes.

The lower portion of the transversalis runs nearly parallel to the former, but arises only from one third of Poupart's ligament; passing beneath, and concealed by the internal oblique. The fibres also cross the spermatic cord and end in a tendon, which is connected with that of the latter muscle, and is inserted into the linea alba and pubes. But the tendon of the transversalis descends much lower than that of the internal oblique; and towards the pubes and Gimbernat's ligament, forms a semilunar expansion, which is connected with a fascia presently to be described; it is more particularly by the *union* [author's italics] of these that the abdominal ring is closed behind . . .

. . . When the lower portion of the internal oblique and transversalis muscle are raised from their subadjacent attachments—a layer of fascia is found to be interposed between them, and the peritoneum through which the spermatic vessels emerge from the abdomen. This fascia which I have ventured to name the fascia transversalis varies in density being strong and unyielding towards the ilium, but weak and more cellular towards the pubes . . . . . The strength of this fascia varies in different subjects; but in all cases of inguinal hernia it acquires considerable strength and thickness, especially at its inner edge—and if these parts had been formed without such a provision, the bowels would, in the erect posture, be always capable of passing under the edge of the transversalis muscle—and no person would be free from inguinal hernia."

It was, of course, in order for him to name the fascia transversalis after the transversalis muscle, but since to-day we have renamed the muscle the transversus, then it should be transversus fascia.

In other parts of his work he also describes the layers of the femoral sheath—its false attachment to the crural arch (Poupart's ligament), and its continuity with the transversalis fascia, which lies against and adheres to the edge of the transversalis muscle. The variable extent to which the internal oblique and transversalis muscle extend inferiorly towards the ilio-pectineal line and pubes was also noted by him. It is rather disappointing to find a passage in his book on the structure and diseases of the testis (1830) describing the insertion of the transversalis muscle as being into Poupart's ligament behind the cord, and likewise the transversalis fascia. This disappointment may of course be due to misinterpretation, and I will leave it for the moment, since history, at least for me, was to repeat itself.

Anson and McVay (1940), in their paper on the aponeurotic and fascial continuities in the abdomen, pelvis, and thigh, record their observations on the muscles and fasciæ and bring to one's notice the importance of realizing the presence of fascia on both the superficial and deep aspects of each muscle, making the muscle, as it were, a sandwich filling. The thickness of the 'bread' or fascia on each side may vary according to position, and where the filling is absent they come together and fuse, and if the muscle substance is replaced by aponeurosis, this will become the filling and fuse with the fascial coverings. In the case of the external oblique the layers on the superficial and deep surfaces fuse at the free border of the inguinal ligament to become continuous with the fascia lata of the thigh, and at the external inguinal ring to become the external spermatic fascia, containing a few fibres of aponeurosis between them (intercrural fibres). The investing fasciæ of the internal oblique (and cremaster) are very thin and are fused below the arching muscle fibres, becoming attached to Astley Cooper's ligament in front of the transversus fascia.

The transversus abdominis (transversalis of Astley Cooper) likewise has this covering—both layers being strictly transversus fascia (transversalis fascia), superficial and deep, and between these layers lies the muscle or aponeurosis of the transversus itself. The pubic attachments of the transversus with investing fasciæ are described, showing that lateral to the symphysis and pubic tubercle the insertion extends laterally along the pectineal line. Anson and McVay also show a gradual diminution of muscle in the sandwich inferiorly, and of aponeurosis and finally the two fused layers, to form a covering for the femoral vessels (*Fig.* 303).

The many observations concerning the anatomy of this region do, I am sure, corroborate all that Astley Cooper described. The description by Anson

and McVay of the origin of the internal oblique and the transversus muscle from the ilio-psoas fascia, with only a secondary attachment to Poupart's ligament, was not described by him, except that he did acknowledge the great strength of fascia lateral to the femoral vessels. They also point out the frequency and degree with which the muscle-fibres of the internal oblique and transversus extend

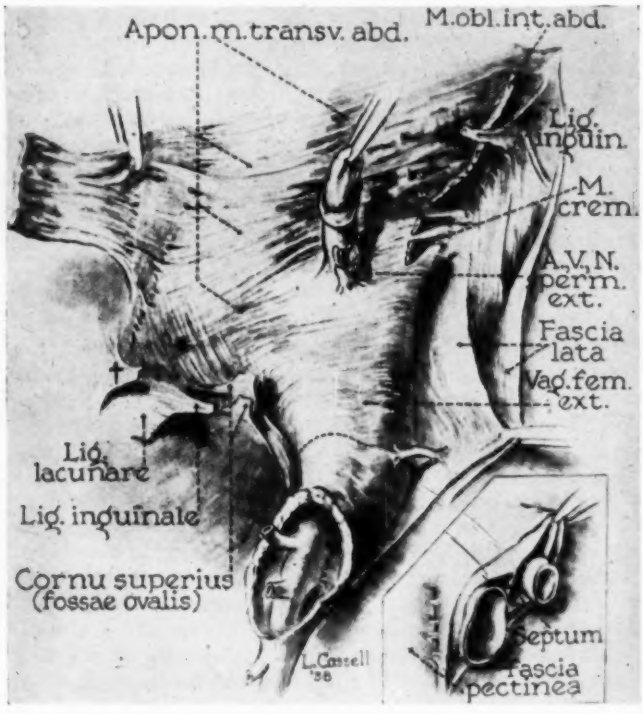


FIG. 303.—Showing the transversus abdominis and its fasciæ with its attachment to the pectineal line medially and its contribution to the inner layer of the femoral sheath, the outer layer from the internal oblique being retracted in the main figure. (*From the original of Fig. 5, Plate 2, C. B. McVay and B. J. Anson, 'Anat. Rec.', 76, 227.*)

inferiorly towards Astley Cooper's ligament. The seeming repetition of history is that these authors should, in a later paper, refer to the transversus fascia and internal oblique as joining the inguinal ligament and then should advocate (Zimmerman, 1938) suturing a flap of the external oblique aponeurosis to that of the transversus muscle as a method of preventing direct recurrence.

Once again, perhaps, I have misinterpreted what appear to be contradictory descriptions of the attachments of the conjoined muscles, aponeurosis, and fasciæ. Fortunately Anson and McVay in a different paper (1942) show that the inguinal ligament (external oblique), internal oblique, and transversus aponeurosis all meet together at Astley Cooper's ligament as well as over the pubes; the external oblique achieving this by means of the incurving fibres of Gimbernat's ligament. This fits in with one's own observations on the living anatomy. I still cannot understand their advocacy (1938) of the use of the external oblique flap as the basis of repair —still the almost magic influence of Bassini!

The Evidence of Comparative Anatomy and Studies in Function.—Sir Arthur Keith (1924) in the Mitchell Banks Lecture of 1923 quoted Sir Victor Horsley as saying in 1914 that the radical cure for hernia is its prevention; and he added that to prevent it we must first discover the cause. This would seem to apply very well to our present question concerning the prevention or curing of recurrence. Sir Arthur Keith was not, at least in this lecture, concerned with bare anatomical truths, but with the function of the part; he might well be described as being a founder of the general concept of anatomy teaching to-day. His great contribution to the function of the inguinal region was his description of the inguinal shutter, the outer guard being the external oblique and the inner guard being due to the combined efforts of the internal oblique and transversus muscle, which would contract and oppose themselves to Poupart's ligament and thus close the weak posterior wall of the canal. He noted that there was a neuro-muscular reflex via the twelfth dorsal nerve causing this contraction, for example, on coughing, straining, or standing. "Who has looked", he said, "to see if this reflex is effective or not in the groin of those infants who suffer from hernia. Will not a disturbance along the gastro-intestinal tract inhibit the working of this reflex?"

It will be noted that Poupart's ligament was regarded as of special importance; "A structure", he says, "that is peculiar to man". If this is true surely it must be of little account in the mechanism of closing the gap in the posterior inguinal wall, as this must occur in the groins of animals as well. However, I think that there is no doubt that his neuromuscular shutter mechanism is the correct conception, but interpretation should be different, as will be seen in the next section. The problem of the repair of the indirect hernia and the indirect recurrence has now begun to intrude.

Lunn (1948), in his Arris and Gale Lecture, begins by stressing the difficulties that have been made for progress by the changes in terminology, and then makes his contribution through a practical study of the comparative anatomy of the groin. He states that, although the inguinal ligament has been found to exist in quadrupeds, it is not responsible for the inguinal shutter mechanism which is, in effect, based upon the bone of the pelvic girdle. With reference to the insertion of the internal oblique and transversus muscles it is evident, in animals which depend so much upon the bony basis mentioned above, that their insertion tends to be along the pectineal line, and in man this attachment may be attenuated in greater or lesser degree. In animals, the 'transversalis fascia', as we recognize it in man, is absent, for the posterior inguinal wall is fully muscular or aponeurotic, and, although Lunn does not mention it, this to my mind supports the theory that, in places, the human anatomy is made up of the remnants of the fused sandwich-like structures of muscle, aponeurosis, and covering fasciæ. His conclusions support Keith's neuromuscular reflex theory; he suggests that there is no justification for the arbitrary separation of the anatomy of inguinal hernia from that of femoral, and he criticizes the principles of Bassini's operation, urging that the normal bony basis, the pectineal line, covered with Astley Cooper's ligament, be used, thereby restoring the conjoined tendon to its normal insertion.

Tackling the problem by a different method, i.e., surgical triangulation, Dugdale and Burton (1948) come to the same conclusions regarding Astley Cooper's ligament and its use as the basis of repair procedures.

I must also mention Lytle's thesis (1945) that the internal ring has a mobility dependent upon the 'transversalis fascia' condensation or sling, attached to the deep aspect of the transversalis fascia (transversus), and that when it is stretched, its repair (i.e., the transversalis or transversus fascia stitch) is of vital importance in restoring the canal to normal.

My object is to try to bring together and to harmonize all these major contributions and to associate them with my own personal observations and interpretations.

Personal Observations and Interpretations.—My own study of the inguinal region has been by dissection at autopsy of the groin of the newborn, at operations on infants, and at every operation for hernia in the adult. Clinical photography has been used to show the living anatomy of the part (*see Figs.* 305, 314–321).

Two interesting points arise out of the examination of the newborn. First, it is evident that the transversus and internal oblique muscles do appear to gain their inguinal origins from the iliopsoas fascia (Anson and McVay, 1940), and, secondly, that the attachment of the rectus and the three sheet muscles of the abdomen to the pubis, and their relationship to the pectineal line of that bone, are also as they

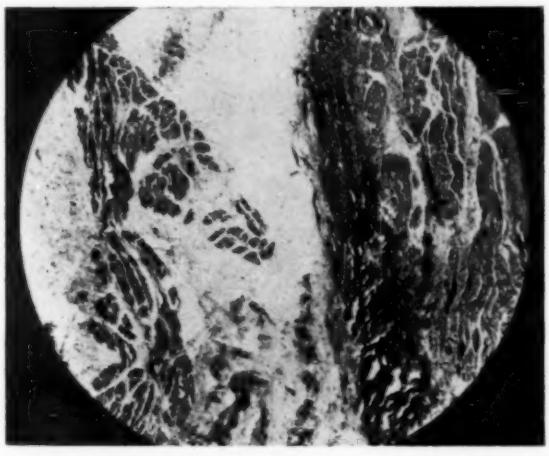


FIG. 304.—The muscular attachments to the pubis and pectineal line (Astley Cooper's ligament) in the newborn child, showing the conjoined muscle to the left, and Astley Cooper's ligament below; the rectus sheath and muscle is to the right of the midline of the photograph. (× 27.)

described. The rectus insertion at this age spreads laterally in a complete muscular state along this line deep to the outer muscles.

Muscle is also to be seen in the conjoined muscle and tendon (aponeurosis) attachment which lies slightly anterior to the rectus but still along this line, the external oblique curving in to meet them on the slopes of the ridge (*Fig.* 304). I did not study the neuromuscular mechanism at operation, for operations on hernia in infants are infrequent in the first year, and technical difficulties such as suiting the anæsthetic to the use of faradic and galvanic currents will need to be solved.

Table II.—TABLE SHOWING THE LARGE NUMBER OF HERNIÆ THAT APPEAR IN THE FIRST YEAR OF LIFE COMPARED WITH OTHER YEARS. (*After Macready, by kind permission of Charles Griffin & Co., Ltd., London.*)

PART I.—*Male Cases seen at the Truss Society in the Years* 1888, 1889, 1890, *entered according to the Age and Side affected when the Hernia first appeared.*

	TOTAL	Under 1	1–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	66–70	71–75	76–80	81–85	86–90
Inguinal.—Right ..	10,082	2020	463	233	390	943	1025	918	835	737	663	607	449	334	251	140	45	26	3	—
,, Left ..	6630	734	175	137	233	641	816	716	670	596	515	472	341	277	177	90	36	1	3	—
,, Double ..	826	404	32	20	11	32	37	46	49	49	45	30	28	19	17	4	3	—	—	—
	17,538	3158	670	390	634	1616	1878	1680	1554	1382	1223	1109	818	630	445	234	84	27	6	—
Femoral.—Right ..	268	—	—	6	8	12	12	28	30	37	24	41	19	21	17	6	7	—	—	—
,, Left ..	181	—	—	4	3	13	16	25	20	15	22	20	16	12	11	3	—	1	—	—
,, Double ..	12	—	—	1	—	—	1	1	2	1	3	1	1	—	—	1	—	—	—	—
Total males, 17,999.	461	—	—	11	11	25	29	54	52	53	49	62	36	33	28	10	7	1	—	—

PART II.—*Contains the same Cases as Part I, entered according to the Age of the Patient and the kind of Rupture at the time of his visit to the Society.*

Inguinal.—Right ..	6685	566	759	317	254	327	420	485	500	522	458	518	403	410	290	268	121	53	14	—
,, Left ..	3884	170	237	115	102	171	282	330	363	388	347	346	265	286	234	141	66	34	7	—
,, Double ..	6860	256	280	125	132	143	253	362	480	604	627	765	662	732	579	458	284	87	24	7
	17,429	992	1276	557	488	641	955	1177	1343	1514	1432	1629	1330	1428	1103	867	471	174	45	7
Femoral.—Right ..	172	—	—	1	3	1	3	10	10	18	16	32	25	19	14	10	10	—	—	—
,, Left ..	111	—	—	2	1	4	11	2	4	10	11	12	18	9	16	7	3	1	—	—
,, Double ..	90	—	—	—	—	2	1	4	2	6	13	8	14	12	9	9	5	5	—	—
	373	—	—	3	4	7	15	16	16	34	40	52	57	40	39	26	18	6	—	—

The first year is, to my mind, important in view of the number of herniæ that occur at this time

(*Table II*), and I have wondered whether the neuromuscular reflex is upset or working at a disadvantage, at least in the first year, when myelinization of the pyramidal tract has yet to take place, in addition to the strain imposed upon the muscle by the recent natural operation of testicular descent.

Observations on the living anatomy of the child, and especially in 'cryptorchids', also show the same muscular insertions of the rectus and conjoined muscles which become corresponding layers of aponeurosis or condensation of 'fascia' that are found in the dissection of the adult. It is therefore reasonable to suppose that these muscular derivatives are the sole source of the various ligaments that have in the past been described in this region (i.e., Henle's ligament or reflected part of inguinal ligament for the rectus muscle in infants and the aponeurosis in adults: interfoveolar ligament of Hesselbach, being the remains of the conjoined muscle) (*Fig.* 305). If this be so then there is little need to regard these ligaments as separate and distinct entities. Their attachment bears the same anteroposterior relationship with respect to the brim of the pelvis as do the muscles in animals or infants, the rectus aponeurosis being posterior upon the summit, and the transversus and internal oblique aponeurosis being slightly in front, the incurving fibres of the external oblique (Gimbernat's ligament) joining them on the slopes of the pectineus. (*Fig.* 306.)

Is it not time for standardization of terminology in this region? I have referred constantly to Astley Cooper's ligament because I believe that the term 'iliopectineal ligament' tells us little or nothing. Surely it must by now be apparent that the ligament is a composite one comprising the insertion to the pectineal line of the rectus and all three sheet muscles. So let it be the 'composite' or 'conjoined' pectineal ligament.

Are the internal oblique and transversus muscles really conjoined? Anatomically they have no reason to be, and at operation it is possible to separate their main parts. Their attachments are, as described above, rather splayed out on the slopes of

FIG. 305.—Dissection of the posterior wall of the inguinal canal at operation, in this case revealing the interfoveolar ligament (remains of the attachment of one or both of the conjoined muscles to Astley Cooper's composite ligament).

the pectineus—the rectus entering the composite area medially and behind. It seems a satisfactory name—'conjoined muscle'—and even though we were to give up 'tendon' and insert 'aponeurosis' it would still not be right from the descriptive, physiological, and, depending on an aspect of technique, the

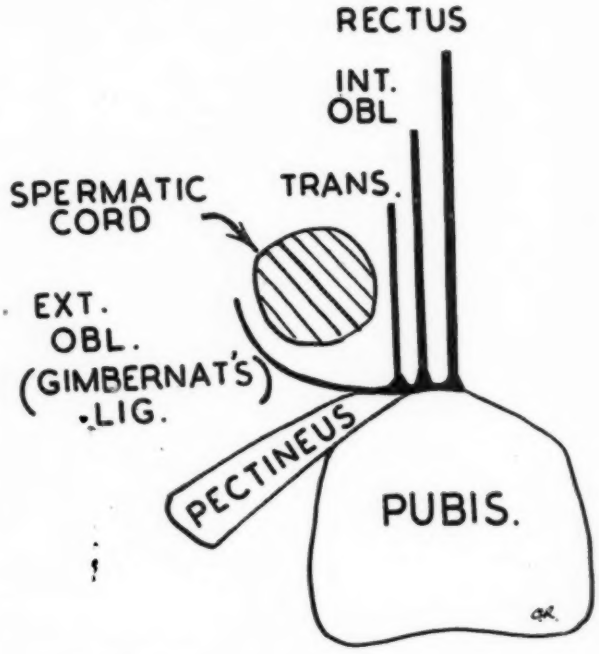


FIG. 306.—A semidiagrammatic sagittal section of the inguinal canal in the region of Astley Cooper's ligament. Each abdominal muscle shown attached to the ligament is in its aponeurotic or fascial remnant form. The rectus fascia, of course, extends laterally for a limited extent. The presence of the spermatic cord shows how the external oblique is forced to curve backwards to Astley Cooper's ligament.

operative side (stitching the stump of the sac behind the conjoined muscle). The 'composite posterior

inguinal wall' sounds cumbersome, but is probably more completely correct.

If this anatomy is accepted, the next stage is a functional interpretation which I venture to hope may simplify the teaching and understanding.

The Muscular Bridge.—Conceive first the idea of a complete muscular barrier in this region forming a bridge over a 'vascular river' emerging from under it (*Figs.* 303, 307). In doing so the vessels of the 'river' take with them a layer of muscle with fascia on either surface, and this muscle becomes so attenuated that it disappears and the superficial and deep layers of the fascia fuse. The two deep muscles, transversus and internal oblique, take part in this and are therefore responsible for the two layers of fused fascia around the vessels (Astley Cooper, 1827; Anson and McVay, 1940). The outer muscle, the external oblique, and its continuity into the deep fascia of the thigh, escapes from this, the vessels remaining deep to it. The bridge thus formed has a firm foundation on either side, ilium and iliopsoas fascia laterally and the pectineal line medially. The more superficial of the three muscles, the external oblique, is closely associated with the origin of the other two laterally, and would be equally close at their medial attachment if it were not for the separation caused by the 'parasite' of the bridge, namely the gubernaculum and later the spermatic

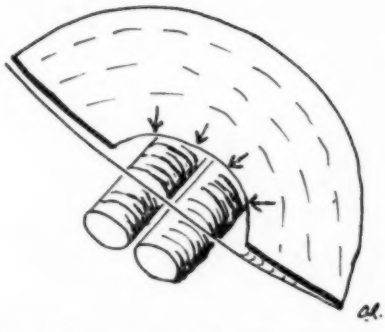


FIG. 307.—The muscular arch over the vessels is shown. The true attachment to iliopsoas fascia laterally is represented distinctly from the inguinal ligament. The medial attachment to the iliopectineal line of the pelvis is shown diagrammatically, as it might be expected to occur in animals or in man in order to obtain the fullest mechanical efficiency to prevent herniation, as shown by the arrows. The medial attachment of the inguinal ligament has been shown as curving slightly backwards, purely for the sake of the diagram.

cord, so that in order to reach the pectineal line it has to curve backwards from this different plane (Gimbernat's ligament).

The Shutter Action of the Muscular Bridge.—In the state described above, the muscular bridge fits snugly over the vessels and prevents the escape of abdominal contents. Under stress and strain this snugness, or tightness, is increased by a neuromuscular mechanism, which, by attempting to attain the shortest distance between the two points of muscular attachment to the bony pelvis affords further protection. Here is the true muscular shutter of the region, the muscle approximating itself backwards to the vessels and not, as was suggested by Sir Arthur Keith, downwards to the terminal ligament and fascia of the external oblique (the inguinal ligament).

Any tendency to interfere with this neuromuscular reflex will upset the perfect function of the shutter and will facilitate the development of a hernia.

On the neurological side there is the suggestion that the slow myelinization of the pyramidal tracts may be a contributory cause in the newborn, with

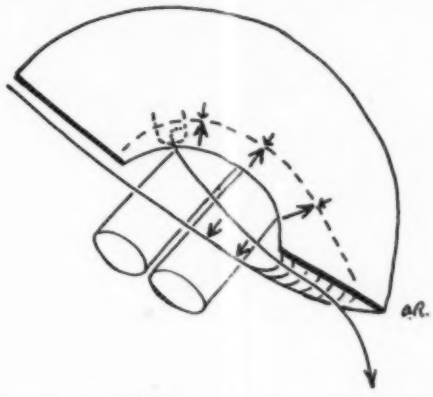


FIG. 308.—This figure is to show: (*a*) The effect of testicular descent, pushing the muscle away from the vessels, thus exposing the internal ring sling, and also pushing the external oblique and therefore the inguinal ligament away, producing Gimbernat's ligament; (*b*) The further weakening of the muscle (upward arrows) that occurs in man, especially medially, so that the interrupted line shows the usual extent of muscular attachment and aponeurosis to the pubis, the remaining becoming 'transversalis fascia' (*see text*).

their recently acquired 'congenital' hernial sac. Most certainly it is known that a right inguinal hernia may follow operation for appendicitis, this being attributed to injury to the twelfth dorsal nerve. For proof on this matter it will be necessary to test the reflex at operation.

Muscular dysfunction may also be developmental or acquired. In the developing child the muscular bridge is penetrated and stretched by the gubernacular bud and descending testicle, so that attainment of the shortest distance between the two points of muscular attachment becomes even more difficult (*Fig.* 308). This parasite of the bridge, with its funicular process of peritoneum, which may well remain permanently (Russell, 1906), takes with it the appropriate muscle and fascial sandwiches, all three of them—the internal oblique being the only one to retain its muscle-fibres in the shape of the cremaster. Having directly penetrated the two internal muscles, the cord, travelling medially, separates the external oblique from them and then perforates it over the pubis, taking with it a fascio-aponeurotic sandwich (external spermatic fascia).

With the passing of the years the medial muscular attachment of the bridge suffers most, and in the adult it is replaced by, in greater or lesser degree, the aponeurotic sandwiches, which fact decreases the efficiency of the shutter, to which is added fatty infiltration and increases in abdominal contents, thereby weakening the mechanism even further, and this, especially in middle age, encourages the direct, bulging hernia (*Fig.* 308). This medial weakness caused by the degeneration of the muscle and in places by frank absence of aponeurosis, is aggravated in the human by the wide angle subtended by the rectus muscle and brim of the pelvis as opposed to the extremely acute angle in the quadrupeds in which

the rectus must, in some degree, protect the conjoined or composite insertion (*Fig.* 309).

It would seem, therefore, that the genesis of inguinal herniæ, either obliquely as a result of filling of the developmental funicular sac, or directly as a

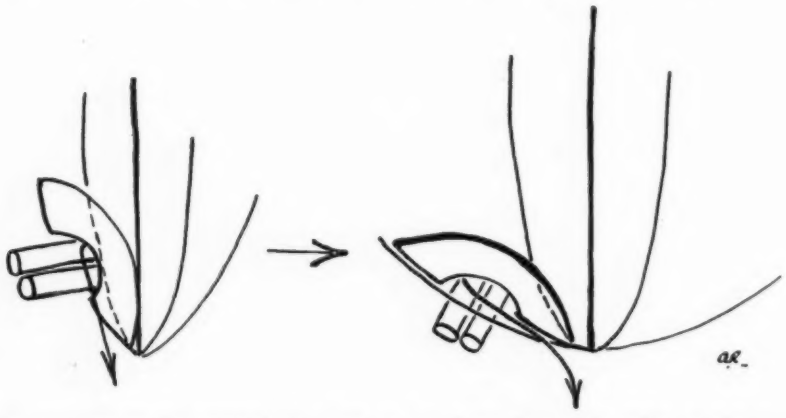


FIG. 309.—Shows the 'protective' action of the rectus in animals which is lost in man. The attachment of the rectus laterally to the iliopectineal line is not shown, but when present in a true muscular state will further strengthen the area.

medial bulge, centres around defects in the neuromuscular mechanism. Such neurogenic and muscular defects as I have described, whether congenital or acquired, may have their parallel in the development of the diaphragmatic hiatus hernia.

The Principles of Operation.—Thus, on the grounds of topographical, comparative, and physiological anatomy, the case for the employment of Astley Cooper's composite ligament in the repair of hernia is once more urged, with the hope that the

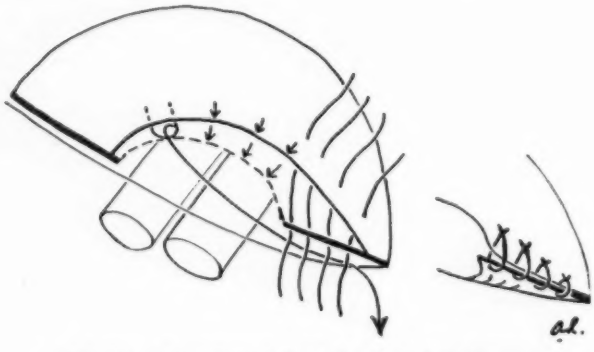


FIG. 310.—A continuous line is in place of the interrupted line of *Fig.* 308, showing the normal adult state of affairs. The placing of the reinsertion and approximation sutures are shown, bringing the muscle once more over the vessels, and covering the internal ring sling which may have already been repaired in the operation (Lytle).

fascination of Bassini's basis for repair may come to an end. The basic repair suggested is the close approximation and reinsertion of the conjoined muscles and aponeurosis to Astley Cooper's composite ligament; not only to cure the direct hernia or prevent a direct recurrence, but also to improve the efficiency of the inguinal shutter mechanism in true fashion, thus preventing an indirect recurrence. To fill with skin, fascia, flaps, or wire lattice the space between Astley Cooper's ligament and the muscles will prevent a direct recurrence but may not improve the efficiency of the shutter. It may be said that if Lytle's opinion regarding its sling-like character and mobility is accepted, the internal ring will take care of itself. This sling-like condensation of fascia is mainly comprised of the two layers of the transversus fascia, and will obviously have mobility when the transversus muscle contracts in its shutter-like action with the internal oblique, thus covering the opening. In the presence of a hernia the sling may, in time, be stretched medially, and, therefore, clean herniotomy and the transversalis stitch are required, moving it laterally once more under the muscular arch. The reinsertion will also achieve this object, as shown in the drawings (*Fig.* 310), so that the two manœuvres combined are not only physiological but should improve the final result.

Fixing the stump of the sac by a stitch laterally behind the muscles will, as has been pointed out by several authors, interfere with the natural sliding action of internal oblique on transversus. From what has been said previously concerning the anatomical inaccuracy of calling them conjoined muscles, the correct though rather more difficult procedure would be to put the stitch through the transversus only, by dissecting in between them and retracting the internal oblique outwards. Functionally, they are still conjoined in action, and I do not suppose that a catgut stitch through both would be harmful.

Reinsertion and approximation is performed by a series of interrupted non-absorbable sutures along the composite ligament, the extent being varied in each case. If the musculature and aponeurotic insertion is considered perfectly adequate the procedure should not be carried out at all, though perhaps just one suture may be placed close to the rectus insertion. On finding weak musculature, a weak posterior wall, or both, the full operative reinsertion is carried out and the ligament cleaned by dissection as far as the vascular sheath (*Fig.* 317). If this step is not carried out the repair would proceed on the slopes of the pectineus, which is a poor foundation. Details will be found in the account of the operation, but it may be said here that, like Heritage (1943), one gets the sensation of 'easing' the conjoined muscles and aponeurosis backwards to

the brim of the pelvis, and not of pulling it down as when suturing the muscle to the inguinal ligament. Should there be excessive tension, a relieving rectus sheath incision (Tanner, 1942) may be made. Medially, firm approximation is aimed at, but moving laterally to the femoral vein this is eased off and nowhere are the sutures, which have taken useful bites of muscle and aponeurosis, tied so tightly as to cause a stranglehold or necrosis.

In one case steel wire sutures were used so that an X-ray could be taken to demonstrate their position (*Fig.* 311). Though it is unlikely that the sutures

FIG. 311.—Radiograph showing wire sutures in position after reinsertion.

will, in time, cut out of Astley Cooper's composite ligament, they may do so from the muscle and aponeurosis. Investigation of this problem could be undertaken by placing radio-opaque muscle marked at the site of suture and noting the degree of upward movement over the passage of years (Doran and Lonsdale, 1949). I have not proceeded along these lines sufficiently yet. A slight upward movement of the marker is to be expected, though how much before the sutures can be said to have cut out completely I do not know. Following the basic repair the question arises whether reinforcement should be used and if so with what material? In order to maintain or to restore to as near normal function as possible, the principle described by Patey, of mimicking the line of shutter-like pull on the surface of the muscles is followed, using one's favourite suture material. Although I have used wire in this series, I feel that perhaps strips of fascia would be far more suitable for repair. The material used is placed without tension as a darn extending from the pubis and medial part of Astley Cooper's ligament in a fanwise direction laterally.

(*Figs.* 312, 313.) Patey (1949), however, is still employing the inguinal ligament for this, following Keith's original conception of the neuromuscular shutter. When completed, the external oblique may be overlapped in front of this or behind the cord, thus

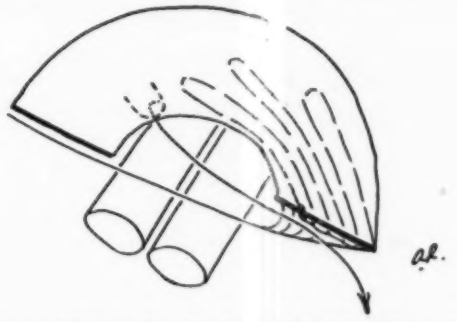


FIG. 312.—Diagram showing the way in which wire or fascia darn is laid over the conjoined muscles.

reverting to a complete muscular and aponeurotic bridge with the cord emerging through all layers at the site of the internal ring. The presence of the cord between the wire darn and external oblique aponeurosis does not seem satisfactory to me and the placing of the aponeurosis of that muscle behind

FIG. 313.—An example of the wire lattice darn. The extent of the darn and gauge of wire varies with each case; in this case fine-gauge twisted wire and a moderate darn was used. There is some difficulty in showing up the inferior part of darn against the bone.

the cord further strengthens the area (Halsted, 1895; Babcock, 1927). The additional repair with wire or fascia fills in the pyramidal depression which occurs after the basic repair, and into which, without wire and fascia, the cord fits snugly.

Heritage (1943) says that he likes to see, during post-operative exercises, the pyramidal depression produced by this technique.

If the basic repair is used even when the external oblique is resutured in its natural position in front of the cord, it is often difficult to leave enough of the upper leaf of cremaster for resuture, which is disappointing.

THE OPERATION

Pre-operative Measures.—As usual, inquiry is made into the past history of chest conditions and an examination of the respiratory system is carried out (together with a routine chest X-ray examination and sputum test). Inquiry is also made into a history of disturbances of micturition, such as difficulty, etc., and a rectal examination may detect the presence of an enlarged prostate.

Before the patient comes to the theatre it should be ascertained whether he has emptied his bladder, and the fact that he has done so is entered on the ward sheet, together with the time, and amount of urine passed. In case of doubt and where the subject is obese and has a large direct inguinal hernia, it may be wise to pass a catheter and empty the bladder. This is of great importance because the bladder must be identified if the ' Astley Cooper ' repair is to be carried out, besides the fact that it may be present in a direct hernia.

Anæsthesia.—Although a local anæsthetic has many adherents in other countries and, with the co-operation of the patient, is useful in demonstrating the muscular action, the need for a good exposure of Astley Cooper's ligament makes it unsatisfactory. A general anæsthetic, with perhaps the administration of curare, gives adequate exposure and permits of the ready approximation to the ligament of muscle, fascia, and aponeurosis of the internal oblique and transversus.

Incision and Technique.—Defining the structures of the cord and the pubic spine medially, and the anterior superior iliac spine laterally, an incision 4 in. to 5 in. in length is made from over the former outwards towards the latter, parallel to, and about ¾ in. above the inguinal ligament. In the outer part it is taken through the fatty and membranous layers, defining and tying between sutures the almost constantly upward running superficial inferior epigastric artery and vein. Having made access beneath the superficial fascia by this method, a finger may be introduced up and down the wound so that scissors may be safely used to open its whole length, further vessels at the medial end being easily caught as they are cut. The shining superficial surface of the external oblique aponeurosis is thus well seen, together with the external ring and intercrural fibres. In the line of the incision a small cut is made in the external oblique in its outer exposed part, showing the muscle-fibres of the internal oblique beneath. Blunt-pointed scissors are introduced outwards and inwards beneath the external oblique, pushing the muscles and ilio-inguinal nerve away from the aponeurosis, which can then be safely divided by the scissors. This division is carried down through the external ring, parting the external spermatic fascia (fused external oblique fascial layers). Useful instruments, not only at this stage but thoughout the operation, are mastoid retractors and Dickson Wright's varicose vein retractors. At first the upper leaf of the divided aponeurosis is lifted up and the muscle and aponeurosis of the internal oblique is pushed gently away by a small dissecting swab on artery forceps, exposing also the lateral part of the rectus sheath as far as where the aponeurosis becomes fused with this structure anteriorly (Anson and McVay, 1937). (*Fig.* 314.) This dissection is repeated below to define the inguinal ligament, the attachment of the internal oblique to this, and the cord with its covering of cremaster. In this way the necessary good clean field for the operation is prepared. After picking up the cremaster with two forceps, it is incised and divided in the line of the cord. This small but important step, completed by the swab on a holder, enables the easy delivery of the cord and hernial sac, if an indirect one, covered by internal spermatic fascia (fused transversus fascial layers) (*Fig.* 315).

The indirect sac may be identified by the crescentic appearance of its lower margin when the cord is splayed out on the fingers, and the isolation of the sac from the cord and transversus fascial

FIG. 314.—The operation for hernia after division and retraction of the aponeurosis of the external oblique. The attachment of this aponeurosis to the anterior rectus sheath is shown (much more medial to the margin of the sheath than used to be supposed). The fine fibres of the cremaster and the ilio-inguinal nerve are also to be seen.

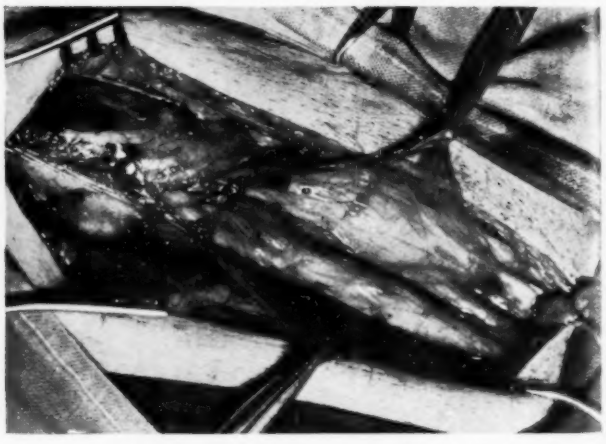


FIG. 315.—Same case as in *Fig.* 314, showing the importance of cleanly dividing the cremaster to enable easy dissection.

layers is easily accomplished. Dissection of course may be long and difficult if the hernial sac is continuous with the tunica vaginalis, is of long standing, or if a truss has been worn. Separation of the layers in these cases may be facilitated by the injection of normal saline around the sac. Having isolated and dissected the sac away from the cord and cleaned the transversus fascia from its neck, it is opened and the size of the neck ascertained, though

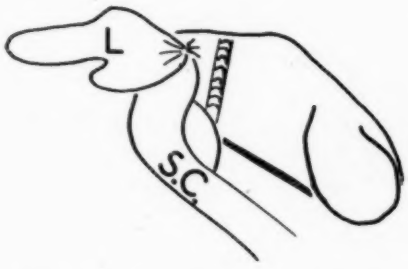


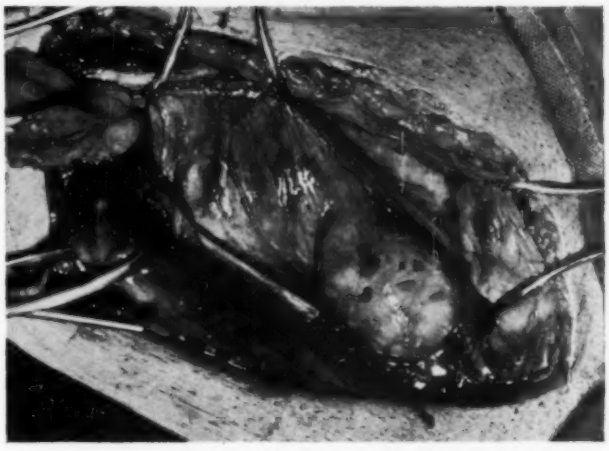
FIG. 316.—Same case as in *Figs.* 314, 315; the conjoined muscles are retracted, showing the composite fascia of the posterior wall of the canal with a direct hernia and 'indirect' lipoma (L in illustrative diagram) S.C., Spermatic cord. The deep inferior epigastric vessels are also shown in this case.

more evidence of the state of the internal ring may be gained by feeling the opening and rim of the transversus fascia over which the cord loops. After transfixion and ligation, and before the excess is removed, traction of the sac laterally is useful in helping one to place suitable sutures in the transversus fascia in order to narrow and move the sling of the internal ring outwards. After removal of the excess sac and inspecting the stump of the sac to

make sure there have been no accidental inclusions, it is hitched laterally behind the transversus and internal oblique with a catgut stitch. The 'pros and cons' of this step have already been discussed.

Having completed this part of the operation, attention is directed to the posterior wall of the canal, ascertaining whether the muscle of the shutter is satisfactory and capable of working to full mechanical advantage. If this is so, the cremaster is repaired, and external oblique overlapped in front of the cord. I have already discussed the varying extent of repair that can be performed to assist the shutter mechanism, prevent indirect recurrence, or to act as a barrier to direct recurrence (*Figs.* 310, 312). The operative details follow after the next paragraph.

If a direct hernia is the reason for operation, exploration of the cord is carried out first to make sure that no congenital indirect sac is present, which although not being patent, may, by being undetected,



give rise to an indirect (false anatomical) recurrence later—(cf. lipoma in *Fig.* 316). The direct sac may be merely in the nature of a bulge, with wide neck, in the internal oblique and transversus aponeuroses and fasciæ, but also may be funicular in character (Hamilton Russell, 1906, and Ogilvie, 1937). Whether bulge or sac, it is dissected out and isolated, and at this stage Astley Cooper's composite ligament is also defined, and, deep to this, the fatty covering of the bladder (*Fig.* 317). The bladder quite often presents over Astley Cooper's ligament, being in fact the medial wall of a sliding direct hernia. In one case

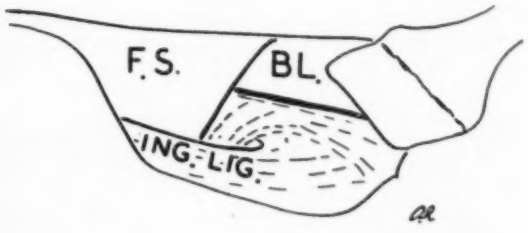


FIG. 317.—Same case as in *Fig.* 316; Astley Cooper's ligament has been cleanly dissected out after the direct hernia has been dealt with. F.S., Femoral sheath; BL., Bladder. Notice the strand-like character of the inguinal ligament (ING. LIG.) also described by Anson and McVay.

I mistook it for a lipomatous collection and inadvertently opened it with my finger. Often the direct bulge may be easily pushed back into the abdomen and held there while the repair is being carried out, but in other cases, including of course those with a funicular type of sac, a herniotomy with suture of the neck and excision of the redundant tissue is required.

Details of Reinsertion Repair (all hernias when thought necessary).—It must be said once again that although the composite or conjoined aponeurosis and fascia may sometimes appear weak, it is often fairly strong at its site of insertion into Astley

Cooper's ligament, but by careful dissection with scissors, closed dissecting forceps, or dissecting swab

FIG. 318.—Another case. Left inguinal hernia. Dissection shows the femoral sheath and inguinal ligament well. Astley Cooper's ligament not yet dissected out.

it can be raised, thus defining the ligament throughout its whole length (*Fig.* 317). Some small veins, which may be varicose, are nearly always found here, and they may need ligation and removal. I have not been able to identify, with any certainty, the abnormal obturator vessels. In defining Astley Cooper's ligament laterally, care must be taken to avoid

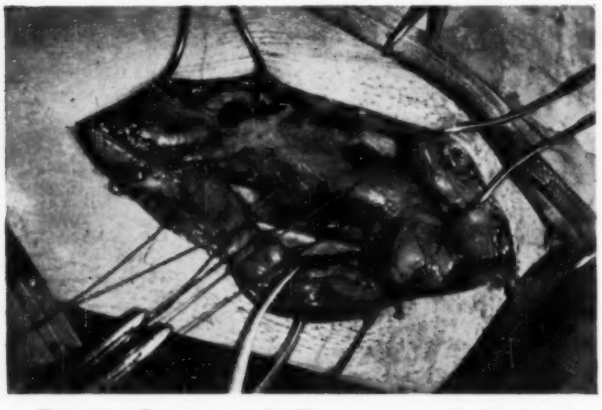


FIG. 320.—Same case as in *Figs.* 314–317; showing thread sutures in position before tying.

injuring the femoral vein, the femoral sheath being easily recognized as it passes over the brim of the pelvis (*Figs.* 317, 318). With adequate retraction, reinsertion repair is now commenced, and this is achieved by using a round-bodied fish-hook needle threaded with No. 3 silk, strong thread, or nylon. The sutures, which may be as many as four or five,

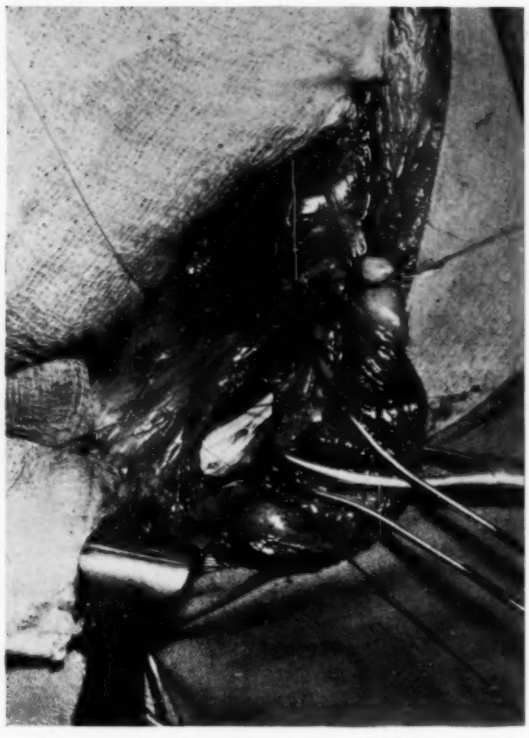


FIG. 319.—Same case as in *Fig.* 318; showing three nylon reinsertion sutures in position. They are seen going over the inguinal ligament, and Astley Cooper's ligament is not seen. This photograph shows what appear to be enormous muscle bites by the sutures, but this is not so, being mainly due to a well-formed upper part of the divided cremaster, which is easily preserved by reefing the upper sutures through its junction with the internal oblique, thus tying the reinsertion sutures deep to it. The catgut transfixion stitch hitching the stump of the sac laterally behind the conjoined muscles is also to be seen.

are passed through the internal oblique and transversus muscles, together with their conjoined

FIG. 321.—As *Figs.* 314–317, and 320, the sutures have been tied. The femoral sheath and canal and the inguinal ligament can be made out. The muscles now fit snugly around the cord. The upper cut margin of the external oblique aponeurosis was also well shown, ready for overlapping in front of the cord.

aponeurosis and fascia, and they take a good bite of Astley Cooper's ligament. The needle may break

unless it is eased carefully through this structure. A cutting needle must not, of course, be used, owing to the close proximity of vascular structures. The most medial sutures also take a bite of rectus sheath and are close to the pubic spine, whilst the lateral one is close to the femoral vein. All sutures are placed in position before tying (*Figs.* 319, 320), which is carried out from medial to lateral, not so much forcibly to bring down the muscles as to ease them backwards and only slightly downwards, as close as possible to the ligament, without exerting a strangle-hold (*Fig.* 321). The degree of tightness of the lateral suture must depend on its proximity to the femoral vein so as not to embarrass the flow of blood in any way, and also on the ease with which it will move backwards. As has already been said, a relieving rectus sheath incision, after the method of Tanner, will, if required, facilitate the procedure. When reinsertion has been completed it will be seen that the muscles now form a very effective barrier, besides having a stronger insertion for more efficient shutter action (*Figs.* 310, 321).

If further repair is required, the reinforcing darn is employed according to the method of Patey already described in the preceding section. Wire was used for this. With reference to suture material, silk was always used until *Case* 75, in which occurred the only infection of the series, and since then I have used nylon except for the final overlapping suture of the external oblique, in which catgut is employed because nylon knots may give rise to a pricking sensation. Scarpa's fascia is always resutured with catgut before the skin wound is finally closed.

Table III.—Analysis of the Extent of Repair in Operation for Inguinal Hernia in 115 Male Cases During 1948 and 1949

		Cases	
A =	Herniotomy, with or without transversus stitch	29	(all indirect herniæ)
B = A +	Astley Cooper Repair, with external oblique repair in front of cord	47	(including 4 direct herniæ. Nil recurrent herniæ)
C = A +	Astley Cooper Repair, with external oblique repair behind cord	14	(including 7 direct herniæ. Nil recurrent herniæ)
D = A +	Astley Cooper Repair, with additional reinforcement repair using wire darn	25	(including 8 direct herniæ. 8 recurrences)
	Total	115	

AGE AND TYPE OF PATIENT

The average age of patient in this series is 42 years. This in itself means very little except a tendency towards the high side. I have divided the patients into age groups as follows (*Table IV*).

This is more explicit and shows that half of the operations were in people between 40 and 60 years old. There are not a great many patients with trusses in North Bedfordshire because of the particular type of patient. They are mainly farmers, market gardeners, or other agricultural workers, to whom a truss is a hindrance. Perspiration soon rots its leather coverings, and a year, even with repair, is its maximum life. These country folk want an operation if it is at all possible. They do not necessarily have good musculature and often tend to be obese. To have a patient of 71 years in the series is due to the inclusion of five emergency cases. These

Table IV.—Age Groups of Patients

	Patients	*Operations*	
Under 20 years	3	3	
20–29 years	20	21	Larger number of operations due to 14 bilateral herniæ
30–39 years	19	22	
40–49 years	20	22	
50–59 years	28	34	
Over 60 years	11	13	
	101	115	

Youngest patient 17 years, oldest 71 years.

emergency operations were for irreducibility or obstruction in which it was possible to proceed with the Astley Cooper repair. No operations for strangulated hernia are included, as repair was not carried out for obvious reasons.

COMPLICATIONS

Hæmorrhage.—In no case did reactionary hæmorrhage occur to cause anxiety or to require operative measures. This includes hæmatoma of the cord.

Micturition.—Following the Astley Cooper type of repair some difficulty with micturition is encountered during the first 48 hours in 30 per cent of cases, an incidence probably more frequent than after other repairs. This is probably due to the close proximity of the repair to the bladder, as also to the definition of this structure during operation.

Pulmonary Embolus.—One massive embolus caused sudden death. There was no clinical or post-mortem evidence of thrombosis in the calf, and it appeared to come from the left internal iliac vein. One minor case occurred and this, too, showed no clinical evidence of thrombosis in the calf.

Deaths.—There were no deaths other than the one reported above.

Infection.—There was one case of infection of sufficient degree to cause delay in the patient's final recovery. This occurred following the use of silk twist, and resulted in a small discharging sinus for three months, which ultimately produced a silk suture and then finally healed. Stitch abscesses were not met with, though on two or three occasions the wound appeared red and inflamed for a few days. Special attention was always paid to the suture of the skin at the medial part of the wound over the pubis, since it and the subcutaneous tissue are of a different texture from the tissues more laterally. The sutures seemed to need to be placed nearer together than in the lateral part, thus avoiding gaping between the stitches and a residual tender scar. In one case the wound gaped open after removal of sutures, and required secondary approximation.

Other Symptoms, etc.—Immediately following the operation the patient often reports a feeling of tightness at the site of the operation, but this quickly passes off. Any persistent pain or discomfort has probably been from the use of nylon or wire, and three patients still claim that they have such discomfort.

Atrophy of the testis is known to have resulted in one case (*Case* 88), when the external oblique was overlapped behind the cord. Since this case I have always made a small cross-cut in the external oblique at the site of emergence of the cord to prevent this. Halsted reported 3 cases in his first series.

There is one patient who has suffered from back pain, headache, inability to work, and other neurotic symptoms ever since the operation. He must be mentioned, as he is, at least, a failure economically.

CONVALESCENCE

The patients were first allowed up between the tenth and seventeenth day, depending on the size of hernia found at operation and the extent of repair required; and were discharged, if possible, to our convalescent home for a further two weeks. They were instructed not to restart work for at least six weeks after operation, and then only if sedentary or light work were possible. Full work of a heavy nature was not to be attempted for between three to six months. Stress was laid more particularly on the avoidance of stretching and striding and the sudden 'taking-the-strain' of heavy weights. Resumption of full work followed examination at the Out-Patient Department. In some cases it was necessary to help the patients to find other types of employment, and one always found the almoners and social service workers of inestimable value in this respect.

FOLLOW-UP OF CASES

The patients were seen first at one month, and then again at three months after the operation, and they are still being seen at six- and twelve-monthly intervals, depending on their progress. Since the introduction of a new filing system at Bedford, this has been even more easily carried out than at the start of the series. Out of 101 patients (115 operations), 67 (77 operations) are still regularly attending the Out-Patient Department. Besides being seen in this way, and in order to obtain the necessary information regarding the remaining 34 patients (1 having died) attending irregularly, I have corresponded with every patient so that the results may be completely up to date. I have asked them whether, in their opinion, the operation has been successful, especially with regard to their ability to perform their normal work, and also whether they have required to obtain further surgical advice or treatment. Follow-up purely by correspondence is, of course, not satisfactory (Zimmerman, 1939), but has been additionally chosen in this series to bring all the cases into line at the same moment—otherwise it would not be possible to view the cases together at the same time. Unlike hospitals in so many large towns and cities, Bedford County Hospital was the only one serving this particular area, and therefore any patient who thought he had a recurrence would be more likely to be returned to that hospital by the very loyal practitioners who serve the area than to be sent elsewhere. However, I felt that by private correspondence I could be sure of this point (two recurrences were found in this way). I have been unable to contact 9 of the 34 patients (9 operations), 6 of them being young foreign workers.

Length of Follow-up.—No patients in this series have had their operation less than one year ago. There are 55 operations performed between 1 and 2 years, and 61 operations between 2 and 3 years ago.

Recurrences.—A total of 115 operations is not a great number, and the length of the follow-up is not very long, so that this report of the success or otherwise of the procedure in this series can only be a preliminary one.

If we accept the findings of Page and Edwards (1943) and Edwards (1943), Judd (1908), and Erdman (1923) on the length of the interval between operation and the patient becoming aware of the recurrence, namely that approximately 75 per cent of recurrences appear in the first twelve months, and 90 per cent in the first twenty-four, then almost 90 per cent of the potential recurrences in this series have already developed.

The difficulty of deciding what does or does not constitute a recurrence once again arises. If we let the patient decide, there are four recurrences in this series. If we let the result of medical examination at follow-up also contribute, there are these four plus another two 'bulges' that are being watched.

In detail these are:—

Recurrences:—

Case 51.—Age 47 years. Originally operated on in June, 1949, for a left indirect inguinal and a fatty hernia of the linea alba. The repair after herniotomy and transversus fascia stitch was by the reinsertion repair only, the external oblique being resutured in its normal position. Recurrence occurred nine months after operation. At the second operation he had a true anatomical indirect recurrence 2½ in. long, and also a direct weakness. It appears that the whole of the reinsertion repair had failed, the sutures (silk) having probably cut out. If one accepts Sir Arthur Keith's theory that the extraperitoneal fat acts as a 'piledriver' finding out all the weaknesses, the presence of the fatty hernia of the linea alba should have warned me to include the additional reinforcing repair in dealing with the inguinal hernia.

Case 60.—Age 52 years. Operation April, 1949—right indirect inguinal hernia; repair by herniotomy, transversus stitch, and Astley Cooper reinsertion. Patient complained of the sudden appearance of recurrence nine months later. He is an office worker and says that he does not want another operation.

Case 78.—Age 61 years. Bilateral direct hernia in July, 1949. Reinsertion repair with wire darn superadded. Complains of bulge at the outer end of the right wound; it appeared about six months after operation. He is awaiting re-admission for repair of this. Left wound satisfactory.

Case 79.—Age 47 years. Right direct inguinal hernia. Operation July, 1949, by reinsertion repair only. According to the patient recurrence happened suddenly five months later, accompanied by a bulge on the left side. As he may now have bilateral indirect herniæ, was a right congenital indirect sac missed in this case?

Bulges:—

Case 88.—Age 48 years. Bilateral direct hernia August, 1949. Right side was a sliding hernia, the cæcum being the lateral wall. Musculature was very poor. After pushing the bulge back into the abdomen the reinsertion repair with wire darn reinforcement was carried out. Left side shows good result. Right side has a small bulge at the outer end of the incision. The

testis is atrophied on this side. The bulge occurred five months after operation and has not become any larger in the past nine months.

Case 94.—Age 59 years. Right indirect hernia September, 1949. Reinsertion repair, with wire lattice reinforcement because of very poor musculature. Patient is quite satisfied, but he bulges generally around the site of repair, the latter being quite firm.

Comment.—

Age.—All 6 patients are between 47 and 61 years old.

Type of Hernia Originally.—There were 4 direct (one sliding) and 2 indirect. (No recurrences follow the 8 operations for recurrent hernia.)

Time.—All recurrences and bulges appeared within nine months of operation. This is in accordance with the findings of Page (1943), Edwards (1943), Judd (1908), and Erdman (1923).

Musculature.—Obviously poor in 5 of the cases.

Type of Repair.—There were 3 reinsertion, and 3 reinsertion plus reinforcement repairs.

The bulges may not be actual recurrences, occurring as they do around and not through the pyramidal depression caused by the repair. The elongated bulging of the inguinal region that is often associated with weak musculature may merely be accentuated or brought into prominence by the repair at its medial end.

Considering that the problem of the direct hernia was what originally stimulated this work, it is disappointing to note that four of the recurrences and bulges follow the twenty operations for this condition—not a good advertisement. I feel that perhaps a wire, skin, or fascia reinforcing repair must be used in these cases, still using Astley Cooper's ligament for this purpose. Eleven of the direct herniæ were treated by reinsertion alone. Only one direct weakness followed repair for indirect hernia. Further comment is difficult as the numbers are small, but the results are certainly no worse than after any of the Bassini variants, and it is satisfying to know that one is trying a method based on the knowledge of normal anatomy.

Missionary zeal may be said to account for a slight reduction in recurrence rate, though I fear that such zeal must have been wanting in *Cases* 78 and 79, both instances of direct hernia on which operation was performed on the same day.

It is by no means an easy operation to perform, especially in obese patients. It is often stressed that operations for herniæ, using the inguinal ligament as the keystone, are not 'learner's operations'; the operations using Astley Cooper's ligament are even less so. Careful dissection is the rule, and will dictate the time spent, which in the case of reinsertion plus reinforcement repair may take between forty-five minutes and an hour. It is obviously folly to relegate such a procedure to the end of a long operating list when all are tired and have little of the missionary zeal left for that day. Of course this cannot be said to be a disadvantage of the procedure, but rather of long operating lists.

I am confident that operations employing Astley Cooper's composite ligament as the keystone of a standard basic repair will be adopted, for they will be founded on sound anatomical principles. There is, in fact, good reason for change.

SUMMARY

As an introduction, the general problem concerning operations for inguinal hernia is again raised.

Observations on the sites and types of recurrence are made, and the question of repair of the posterior wall of the inguinal canal is explored, thus promoting this study.

The work of descriptive anatomists such as Astley Cooper, and of Anson and McVay, is reviewed and the contribution of Sir Arthur Keith from the functional aspect is analysed. The comparative anatomical studies of Lunn complete the evidence concerning the normal attachment of the sheet muscles of the abdomen and the rectus to the ligament of Astley Cooper.

Personal observations on the newborn infant at autopsy, and on the living anatomy of the child and adult at operation, bear out these descriptions.

Personal interpretations of the observations, and the integration of the contributions mentioned, leads on to an explanation of what is considered to be the true action of the inguinal muscles and their neuromuscular shutter mechanism. Neurological and muscular disturbances of this region are described or postulated as being the cause of filling of the hernial sac at different ages.

A plea is made for a revision of terminology in the inguinal region.

The operative procedures in use to-day are, in general, criticized only because of their use of the inguinal ligament as the scaffolding in the repair of hernia. Instead, the principle of using Astley Cooper's ligament is put forward, and this is not merely in order to repair the direct hernia or to prevent direct recurrence as already propounded by other workers; it is also to help prevent indirect recurrence by improving the neuromuscular mechanism. The operation plans to restore the normal anatomy and function. Any of the modern methods of reinforcement may be used providing thought is first given to function.

The observations, interpretations, and operations are suitably illustrated.

The extent of the operative procedure in 115 cases is analysed, as is the age and type of patient.

The follow-up methods are described.

No case less than one year after operation is reported. In slightly more than half of the cases 2–3 years have elapsed since operation.

The recurrence rate report (necessarily a preliminary one) shows 4 (3·4 per cent) recurrences, plus 2 bulges under observation, these latter being possibly false bulges due to the inguinal depression caused by operation. Allowing for the fact that 90 per cent of recurrences appear in the first two years, further follow-up time, and the suspects becoming full blown recurrences, the rate may tend to 4–5 per cent in this series of 115 cases.

I wish to express my thanks to Mr. W. H. Miller for his encouragement throughout and for allowing me to manage his cases; likewise my thanks are extended to Mr. G. J. Griffiths and Mr. G. S. Storrs.

I am very much indebted to Professor F. A. R. Stammers for his assistance with this paper. Thanks are also due to Dr. D. B. Brewer for the preparation of the slide for *Fig.* 304.

The superlative photography of Mr. T. F. Dee, Clinical Photographer to the Queen Elizabeth Hospital, is very much apparent in this paper, and I am extremely grateful to him for his work in this connexion.

Finally, Miss Mary Hollier, for her valuable assistance in the compilation of this manuscript.

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PROXIMAL APPROACH TO OBLIQUE INGUINAL HERNIA

BY D. S. QUILL

DISSATISFACTION with the long-term results of Bassini's procedure and its modifications, and the anatomical studies of Lytle (1945) and others, have converted modern surgical opinion to belief in the primary importance of repair of the stretched internal ring following adequate removal of the sac, rather than in approximation of the muscular walls of the inguinal canal.

The technique proposed by Lytle follows the traditional exposure. This has a number of disadvantages: First, the difficulty of definition of the sac to a sufficiently high level adequate to remove the pneumatic pressure of the ligatured neck from the neighbourhood of a freshly sutured internal ring; secondly, the danger of missing fine radial tears in the friable peritoneum reached following high separation of the sac; thirdly, the muscular components of the canal are divided and stretched, and any post-operative scarring or fixation of the cord occurs below the level of the internal ring; fourthly, prolapse of the cord if encountered cannot be remedied; and finally, definition of the ring from below is frequently difficult and indistinct. Aird (1949) dryly remarked that drawings of suture of the internal ring are far more numerous than photographs.

Some two years ago it occurred to me that Lytle's objective could be adequately achieved by deserting the inguinal route, and approaching the internal ring and sac from above, but on searching the literature I could find no reference to such an approach with the exception of A. K. Henry's (1937) suggestion of a midline extraperitoneal route.

The following approach was gradually devised and modified, and has now been used on 72 cases:—

An oblique 4-in. incision is made 1 in. above the level of the internal ring, and just crossing the outer border of the rectus (*Fig.* 322).

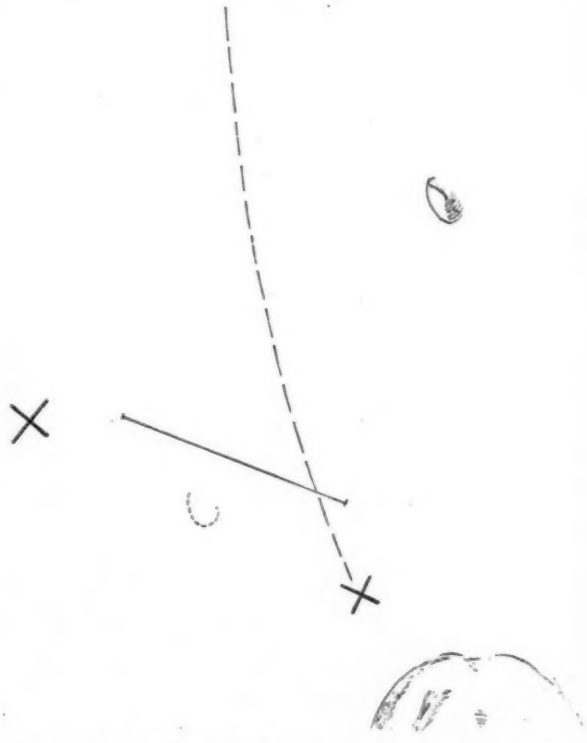

FIG. 322.—Outline of incision in relation to internal ring. (This and all subsequent diagrams are from foot of table.)

The external oblique is divided in the same line. Terminal twigs of the twelfth dorsal and iliohypogastric nerves are seen lying on the conjoint tendon and are avoided. There are usually wide plaques of fibro-fatty tissue between the muscle bundles of

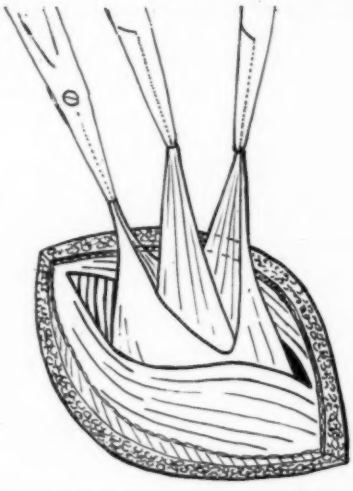

FIG. 323.—Incision completed. Lateral flaps of transversalis fascia defined. Peritoneum held up in central forceps.

the conjoint tendon at this level, particularly near the margin of the rectus. The tendon is split along one of these in gridiron fashion. Once the transversalis is penetrated, the scissors are now opened

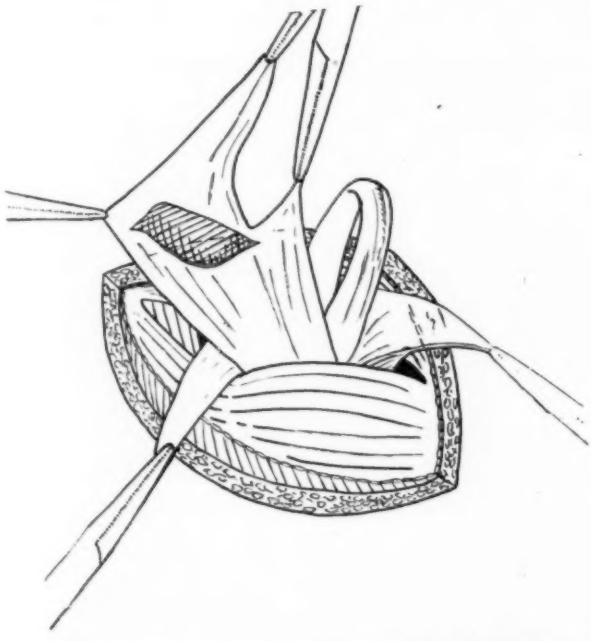

FIG. 325.—Sac freed and opened. Cord held to right. Note finger-like terminal portion of sac, broad wide-necked basal portion. Lateral fascial flaps in forceps lying to either side.

in a sagittal plane through the transversalis fascia and the peritoneum defined. Retractors now draw the gridiron open sufficiently to display clearly the lateral border of the rectus. The peritoneum is picked up, and the edge of the vertically divided transversalis fascia on either side is held, and stripped back to either side (*Fig.* 323).

The peritoneum is now pushed away from the back of the anterior abdominal wall below the incision till the projecting sac is encountered. This is cleared first laterally, and then below, when the

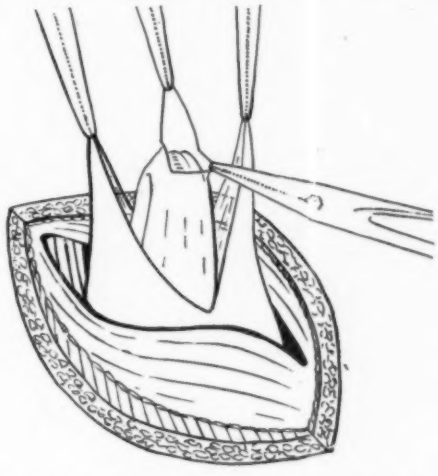

FIG. 324.—Neck of sac and cord freed. Lateral fascial flaps held in forceps.

cord will be encountered. It and the neck of the sac are now lifted laterally, and on clearing their mesial aspect the inferior epigastric artery comes into clear view. If a well-defined external spermatic branch is identified it is divided between ligatures as advocated by Hughes and Fathi (1948). The main trunk of the artery is displaced medially. An incision in the neck of the sac allows introduction

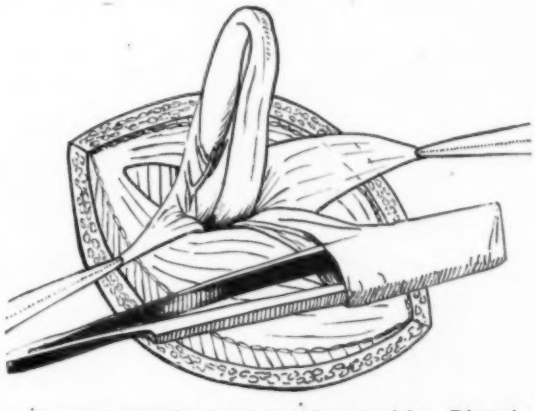

FIG. 326.—Sac freed and turned up to right. Dissecting forceps in lumen. Inferior epigastric gives off external spermatic branch. Fascial flaps in lateral forceps.

of a finger to facilitate extraction of the sac from the canal (*Fig.* 324), and dissection of adhesions to the cord or internal ring resulting from recurrent episodes of incarceration. A very frequent finding is that the sac is a narrow-necked finger-like prolongation on the summit of a broad wide-necked projection (Henry, 1936) with the internal ring separating the two (*Fig.* 325). It will be noticed that in the course of separation of the sac, redundant cord has come back with it above the internal ring.

The neck of the sac is now cleared to a high level at all sides (*Fig.* 326), and following inspection of its lumen is twisted, doubly transfixed, and ligatured. The ends of the ligature are left long (*Fig.* 327).

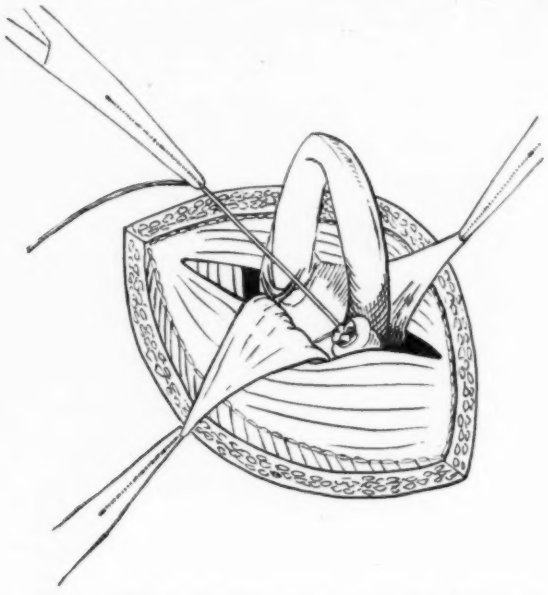

FIG. 327.—Sac ligatured and removed. Stump held down on linen ligature.

The cord is elevated, and with the inferior epigastric artery drawn medially, the internal ring is defined by passing a finger down behind the cord (*Fig.* 328). Its apex can generally be picked up on an artery forceps, or a blunt hook, and successive interrupted sutures are placed, usually three or four till the ring is snugly closed below the cord (*Figs.* 328, 330).

It is now advisable to request an assistant to ensure that the testis on the affected side is properly

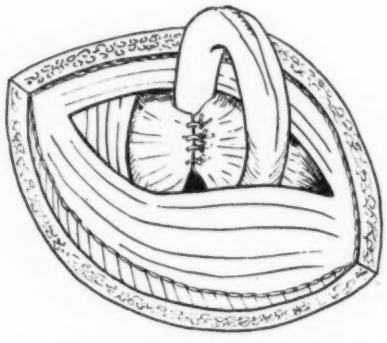

FIG. 329.—Approximation of lateral fascial flaps behind cord following closure of internal ring.

down in the scrotum, particularly in young individuals, or in a hernia of brief standing. This next step deals adequately with any prolapse of the cord in cases of old standing, but where no prolapse is present may elevate the testis if taken to too high a level. While the assistant checks the level, the two leaves of transversalis fascia originally defined are approximated behind the cord till it lies comfortably with all slack taken up (*Fig.* 329). Two or three interrupted sutures are generally adequate. If the whole of the flaps defined are not utilized by this, the upper residue can be approximated above and in front of the cord. Just before these latter sutures are drawn tight, the stump of the sac is drawn down

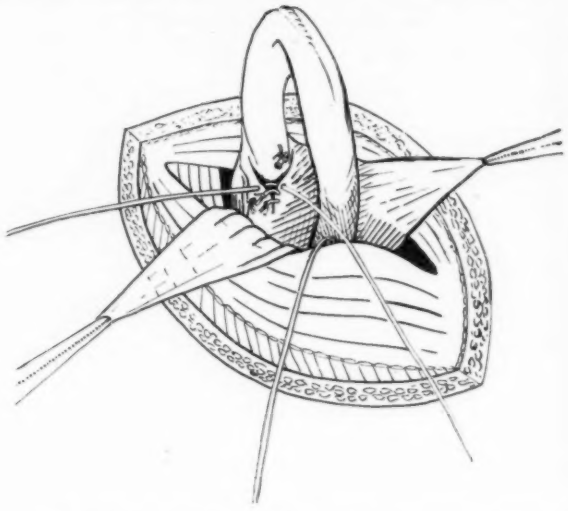

FIG. 328.—Cord elevated. External spermatic branch divided. Internal ring defined and suture in progress. Note degree of retraction of stump of sac.

and thoroughly inspected for secure closure, prior to cutting the ligature short. The gridiron incision is now closed.

FIG. 330.—Exposure of internal ring from above. Viewed from head of table. Cord retracted medially. First suture inserted in ring and held in central artery forceps. Fascial flaps held to either side in lateral artery forceps.

I had become familiar with the approach described by the time a reference to a similar

approach was encountered in the *Medical Annual* of 1938—a précis by Rendle Short of an article by J. E. Sutton (1936) on La Rocque's (1924) abdominal approach to inguinal hernia. La Rocque employed a standard inguinal incision till the conjoint tendon was reached. This was then split an inch above its lower border, allowing access to the neck of the sac. Repair of the internal ring was not stressed, and the operation was concluded with a Willys Andrews repair of the canal. This approach had been employed in 500 cases by La Rocque in 1924, and he stressed its value in the removal of superimposed sacs of the 'pantaloon' or 'saddle bag' type. Henry (1936) also stressed the frequency of this formation in advocating an extraperitoneal approach. Even in the United States, however, despite recommendation of abdominal approach by a number of surgeons, Carrington Williams (1947), discussing its use in sliding hernia, remarked that a general inquiry addressed to 240 United States surgeons showed that 69 used the abdominal approach, 15 used it occasionally, and 156 did not use it at all. I have not employed the La Rocque approach, as by the time I encountered these publications I had become familiar with the procedure detailed, and I doubt if the lower incision through the external oblique would not cramp the exposure available through the subsequent gridiron incision, by the resistance of the upper leaf of the external oblique. Unless a Bassini type repair of the muscular canal is intended there is no advantage to be expected from the lower incision, and there is the possible disadvantage of scarring and fixation of the distal cord.

In one case of right-sided oblique hernia, radio-opaque markers have been placed on the stump of the sac, the highest suture in the internal ring, and the lower border of the external oblique below the ring. Subsequent radiography depicts the wide interval existing between the stump and the ring, and the elevation of the ring behind the conjoint tendon (*Fig.* 331).

Three cases of right-sided sliding hernia were encountered. Correction of this condition from below is both difficult and inadequate. Williams has shown that the sac of a sliding hernia is produced by separation of the mesenteric layers enclosing the affected viscus, thereby transferring the peritoneal reflection from lateral to medial aspect (*Fig.* 332).

The logical treatment of this is reversal of the process by drawing the cæcum and sac up from above,

FIG. 331.—Anteroposterior film of right inguinal hernia. Clips in wound. Upper round marker on suture closing neck. Stainless steel wire is uppermost suture in internal ring. Lower round marker attached to suture in lower free edge of conjoint tendon, exposed from above behind the external oblique.

re-inverting the cæcum into the peritoneal pocket, re-uniting the peritoneal folds behind it. The proximal route permits this reduction to be reinforced by fixation of the replaced peritoneal folds to the fascia iliaca at a high level. This concept is not new, as Williams quotes Fiaschi's recommendation of colopexy through a gridiron incision, prior to inguinal herniorrhaphy, made as long ago as 1907. Williams reported a large series of sliding herniæ treated through La Rocque's approach with a very low rate of recurrence.

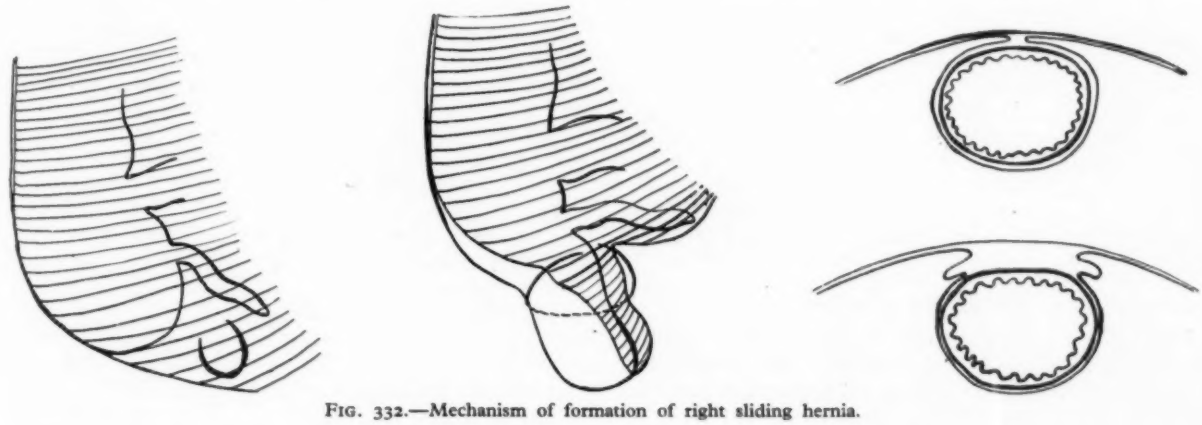

FIG. 332.—Mechanism of formation of right sliding hernia.

It is of course as yet too early to assess the value of a procedure when the majority of cases extend

only over the past year and a half, but there has been no recurrence to date, and no sequelæ indicative of undue compression or tension on the cord. A description is given at this stage because I consider the method deserves a trial from those with access to a larger number of cases than I could obtain over a limited period. Once familiarity with the approach is acquired, and the ease of access appreciated, it is difficult to comprehend the scant attention it has received in British surgery.

CONCLUSION

A proximal approach to oblique inguinal hernia is described. This aims at separation of the sac or sacs to a higher level than is feasible through the classical approach, avoidance of trauma to the internal ring entailed in defining peritoneal bulges above it, and facility for thorough inspection of the stump following ligature.

Closure of the ring from above, with control of the inferior epigastric artery under direct vision.

Support of the cord by an additional flap of transversalis fascia, and correction of prolapse if present.

Avoidance of trauma to the structures in the inguinal canal.

I should like to acknowledge the assistance given by Mrs. F. C. Henry in connexion with the illustrations.

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THE POSTERIOR WALL OF THE INGUINAL CANAL

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THIS investigation of the anatomy of the inguinal region was undertaken in view of the opinions and interest expressed regarding the functional aspects of the inguinal canal by various authors (Patey, 1949; Lytle, 1945).

MATERIAL

Sixty inguinal canals have been dissected, of which 44 were male and 16 female. Two of the male canals were studied in transverse section and the others were treated by straight dissection. Since clear demonstration of the fascial layers in the inguinal region is not always easy in the prepared dissecting-room subject, most of the dissections were carried out on post-mortem material. Some of the dissections were performed in situ and in other instances the lower part of the anterior abdominal wall was removed and fixed prior to dissection.

OBSERVATIONS

In general the anatomy of this region as given in standard text-books is confirmed, but comment is offered on certain structures related to the posterior wall.

1. The Cremaster.—The cremaster muscle is usually described as being continuous with the lowest fibres of the internal oblique or occasionally with those of the transversus abdominis, its fibres descending for variable distances on the lateral side of the spermatic cord and forming loops as they ascend on the medial side of the cord to be inserted into the pubic tubercle.

In all the specimens dissected in this series the cremaster exhibited a pointed tendon of origin which pierced the lowest fleshy fibres of the internal oblique in order to gain attachment to the deep aspect of the inguinal ligament (*Fig.* 333).

The muscle belly which continues from the tendon of origin divides into two heads which are superior and inferior, and it is from the inferior head that the superficial cremaster fibres of conventional description spring: no further reference will be made to them. The deep part of the cremaster includes the superior head and part of the inferior head; its fibres dip backwards above and below the cord and gain attachments (which have been demonstrated both by dissection and in transverse section) to the posterior wall of the canal. The attachment of the inferior head is almost entirely fascial, whereas the superior head is attached by musculo-tendinous slips and by cremasteric fascia between the slips. Close to the deep inguinal ring the muscle slips are constant, but more medially the attachment is chiefly fascial. Where they meet the posterior wall these fascial fibres pass upwards and downwards and reinforce the posterior wall of the canal.

Anson and McVay (1938) described the lowest fibres of the transversus as continued outwards anterior to the spermatic cord as a thin contribution to its layers. No evidence of such a conformation of the transversus has been found in this series, but it may be that Anson and McVay credited the transversus with the fibres of the superior head of the cremaster which are here described. At their insertion into the posterior wall of the canal these fibres of the cremaster are indeed in series with the transversus but more laterally they are on a plane anterior to this muscle. Moreover, their tendon of origin pierces the fleshy fibres of the internal oblique and the circumflex iliac branch of the external iliac

rtery frequently passes between the transversus nd the cremaster to reach the interval between the ransversus abdominis and internal oblique muscles. When these criteria are employed no doubt remains hat the fibres concerned do in fact belong to the cremaster.

MacLeod (1945) described a double layer of fascia surrounding the cord and passing backwards to the posterior wall of the inguinal canal rather like a mesentery, and named by him 'the suspensory ligament of the cord'. It is suggested that the layers of the suspensory ligament are in fact the medial, fascial part of the cremaster which is connected to the posterior wall of the canal.

MacGregor (1929) described a muscular sphincter completely surrounding the deep inguinal ring and

FIG. 333.—The internal oblique muscle has been incised and the cut portions reflected. The cremaster muscle is exposed and the interval between the cremaster and the transversus has been accentuated. The vessel which emerges between these two muscles is the circumflex iliac branch of the external iliac artery.

composed of fibres of the internal oblique muscle, but this has not been seen in any canal in this series. Although the attachments of the cremaster which have been described do not surround the ring, it is possible that they were the fibres to which he referred.

2. The Internal Oblique and Transversus Abdominis.—It is commonly stated that the lowest fibres of the internal oblique and transversus abdominis take origin from the inguinal ligament. Chandler (1950) found that they arise only to a slight extent from the inguinal ligament and that they are attached mainly to the fused fascial layers (fascia transversalis and fascia iliaca) which lie at a deeper level. In every case this finding has been confirmed, and in transverse section the fused fascial layers are a very evident feature as they pass anteriorly to meet the external oblique aponeurosis.

3. The Conjoint Tendon.—From their origin the lowest fibres of the internal oblique and transversus abdominis pass medially to take part in the formation of the conjoint tendon, but a point might be emphasized here that has not been stressed in recent years but is in *Quain's Anatomy* (1923)—namely, that the transversus may play a much greater part than the internal oblique in the formation of this structure. Of 58 specimens in which this feature was investigated, in 39 canals the major part of the interval between the pubic tubercle and the

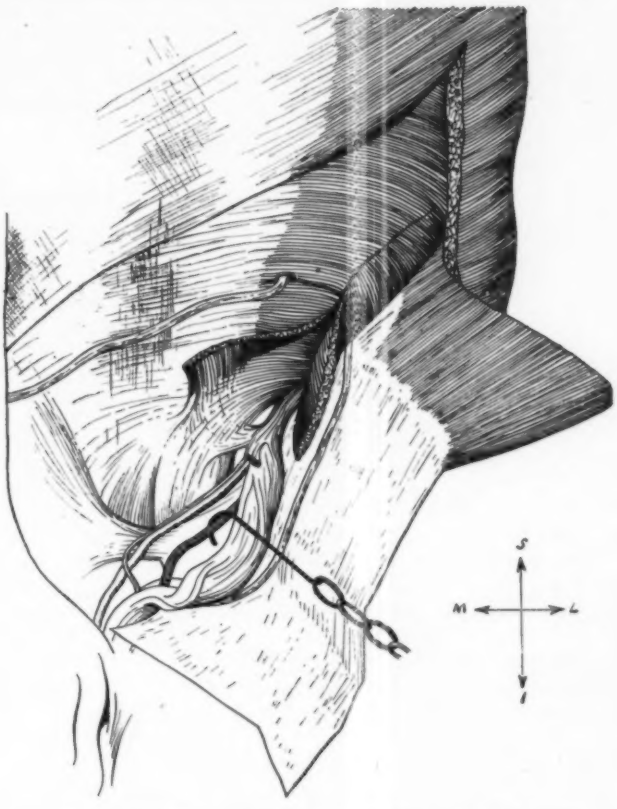

FIG. 334.—The external oblique aponeurosis has been separated from the aponeurosis of the internal oblique as far as the middle line and turned downwards. The ilio-inguinal nerve issues through the fleshy part of the internal oblique and this muscle has been incised and partly reflected. Most of the superior head of the cremaster has been removed.

deep inguinal ring was reinforced by aponeurotic fibres of the transversus abdominis. The shorter aponeurotic fibres of the internal oblique frequently make little or no contribution to the formation of the conjoint tendon, but run straight into the rectus sheath (*Fig.* 334).

Close to the deep inguinal ring the aponeurotic fibres of the transversus sometimes exhibit a slight thickening, and when this is so it constitutes the interfoveolar ligament, though the justification for its consideration as a separate ligament seems to be slight.

4. The Reflected Part of the Inguinal Ligament.—This ligament was present in 50 out of 58 specimens, but it was described by Chandler (1950) in only 3 out of 290 canals. In all of the canals in which this structure was identified its fibres were continuous with the inguinal ligament at its attachment to the pubic tubercle, and, traced upwards, they become continuous with the internal oblique component of the rectus sheath and laterally with the conjoint tendon (*Fig.* 334).

5. The Deep Inguinal Ring.—This orifice has been described by Henry (1937), from the posterior aspect, as a vertical slit, and by Lytle (1945), from both in front and behind, as a strong U-shaped structure.

As seen from the posterior aspect, in all the specimens in this series the deep inguinal ring was a vertical slit with margins that may be described as deep and superficial, and with a short, slightly sickle-shaped, inferior border. This last was never sufficiently evident to justify description of the ring as U-shaped, nor could it be imagined as functioning as a U-shaped sling. However, by putting medial traction on the constituents of the spermatic cord as they emerge from the ring it is possible to convert it into a somewhat U-shaped orifice (*Fig.* 335).

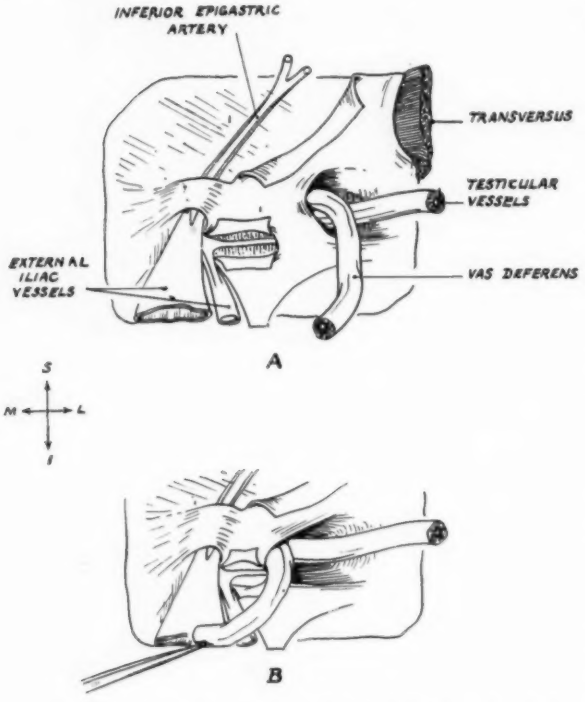

FIG. 335.—A, Illustrates the shape of the deep inguinal ring with the constituents of the spermatic cord in their normal positions. B. Indicates how the ring may be converted into a U shape by medial traction on the vas deferens.

From the anterior aspect, in order to see a ring at all it is necessary to destroy the continuity between internal spermatic and transversalis fascia (Brun, 1950). Moreover, it is necessary to strip away the cremasteric attachments which have been described, and at operation a considerable retraction of the internal oblique muscle and spermatic cord would be involved. The appearances noted from the anterior aspect are therefore the direct result of the techniques employed.

The transversalis fascia of the deep margin of the ring is adherent to the posterior aspect of the transversus and the mobile nature of the deep inguinal ring to which Lytle drew attention is therefore confirmed, for the deep margin of the ring must move when the transversus contracts.

DISCUSSION

The foregoing observations suggest that the transversus abdominis is more important than the internal oblique in respect of the mechanism of the deep inguinal ring, and that when the transversus contracts the deep margin of the ring moves laterally as a result of the attachment of its deep margin to the posterior aspect of the muscle, and at the same time the whole of the posterior wall of the canal is tautened through tension on the same fascial attachments. Meanwhile the aponeurotic fibres of the transversus which turn downwards close to the deep inguinal ring are pulled laterally in the shutter action of the conjoint tendon which was described by Keith (1923). This association of events further accentuates the valvular nature of the deep inguinal ring, the margins of which are pressed into closer apposition by rising intra-abdominal pressure. The muscular fibres of the cremaster which are attached close to the ring also play a part in moving its deep margin laterally, whilst keeping its boundaries snugly opposed to the spermatic cord. The whole of this mechanism achieves an added significance in view of the electromyographic findings of Floyd and Silver (1950), who were able to demonstrate continuous electrical activity in the internal oblique, and presumably the transversus abdominis, in the resting erect posture.

The attachments of the cremasteric fascia which reinforce the medial part of the posterior wall of the canal may not be of direct physiological significance, but it is suggested that division of these fibres at operation weakens the posterior wall of the canal. They do therefore provide an anatomical basis for what has long been part of a recognized technique —namely, leaving the cord undisturbed when only simple excision of an oblique hernial sac is intended (Ogilvie, 1937; MacLeod, 1945). The muscular attachments of the cremaster close to the deep inguinal ring are of direct functional significance and they will certainly be destroyed by mobilization of the cord out to the deep inguinal ring. If they are well developed and intact prior to operation an important part of the defence mechanism at the ring is lost, and existing surgical techniques may not easily compensate for the loss of a functioning muscular mechanism in this situation.

SUMMARY

1. Attachments of the cremaster muscle and cremasteric fascia to the posterior wall of the inguinal canal have been described and their probable importance has been discussed.

2. Chandler's findings in regard to the attachment of the lower fibres of the internal oblique and the transversus abdominis muscles have been confirmed.

3. In 39 out of 58 dissections the transversus abdominis played the major part in the formation of the conjoint tendon.

4. The reflected part of the inguinal ligament was present in 50 out of 58 canals.

5. The description of the deep inguinal ring as a vertical, slit-shaped opening (Henry, 1937) has been confirmed. The functional mechanisms at the ring have been discussed.

It gives me great pleasure to acknowledge much helpful advice in the preparation of this paper which I have received from Professor M. F. Lucas Keene and Mr. Cameron MacLeod. The pathology staff of Kingston Hospital have been very kind in allowing me access to most of the autopsy material used in this investigation.

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CICATRIZING ENTEROCOLITIS

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WHEN, in 1932, Crohn, Ginzburg, and Oppenheimer described 13 cases which showed a necrotizing and cicatrizing lesion confined to the terminal ileum, it appeared that a syndrome with a specific clinical picture and pathology had been segregated from the somewhat puzzling group of conditions affecting that region, and in particular from so-called hypertrophic tuberculosis.

It soon became apparent (Harris, Bell, and Brunn, 1933; Colp, 1934; Crohn and Rosenak, 1936) that a similar lesion could occur elsewhere in the small bowel either in the jejunum or in the ileum, as well as in the colon.

The pathology of the lesions so produced is that of a generalized thickening of all coats of the bowel with or without mucosal ulceration, associated with a 'boggy' mesentery which tends to become adherent over the antimesenteric surface of the affected areas of bowel. In this mesentery are found enlarged fleshy lymph-nodes.

The only accurate account of the histological changes in this condition is that given by Hadfield (1939), based on 20 cases where the lesion was restricted to the terminal ileum. The particular features which he stresses are :—

1. Submucosal coat thickening associated with lymphatic tissue hyperplasia showing well-defined non-caseating giant-cell systems free from acid-fast organisms.

2. Similar lesions were found in the majority of cases in the regional lymph-nodes if sufficiently careful search was undertaken.

3. These changes, it was considered, were associated with obstructive lymphœdema, which was the background cause of much of the bowel wall thickening.

4. When at a later stage mucosal ulceration occurs, secondary subacute lymphadenitis may obscure the typical giant-cell systems to produce a picture of non-specific round-cell infiltration.

The significance of this picture, in contradistinction to tuberculosis, would clearly seem to rest upon the presence or absence of caseation and more particularly on the failure to find tubercle bacilli.

When lesions in the colon are examined the features of thickening of the bowel wall associated with stenosis and ulceration make the picture remarkably similar to that found in many cases of non-specific ulcerative colitis, and Bockus (1944), giving the title of 'regional enterocolitis' to such cases, states that " the disease in the colon does not differ pathologically from that seen in ordinary idiopathic ulcerative colitis ".

Devine (1950), in discussing 100 cases and 341 mortality figures of ulcerative colitis, states that the disease usually occurs first near the rectosigmoid junction though it may commence anywhere in the colon. He describes examples which remain regional, although he is of the opinion that such cases, if followed for a sufficiently long period, become generalized. Ulcerative colitis of regional type has also been described by Bargen and Weber (1930) and Hopping and Bargen (1942).

From the clinical standpoint, whilst many cases of regional enterocolitis present either as a right iliac fossa syndrome simulating appendicitis or as cases of intestinal obstruction, there is a very definite group presenting as an 'ulcerative colitis' syndrome where the major symptom is intermittent diarrhœa.

Bockus has observed, following a study of his series, that those cases which show this type of clinical picture are usually those where an extensive area of colon is involved.

It seems suggestive, therefore, that the non-specific clinical picture of 'ulcerative colitis' is not so much a manifestation of any particular disease process as merely a non-specific response to certain stimuli when they affect the colon. This is further emphasized by the fact that in those conditions where a specific aetiology is demonstrable, such as bacillary and amœbic dysentery, an essentially similar clinico-pathological picture is produced. Further, when one considers that the condition of idiopathic ulcerative colitis, although most commonly affecting the rectosigmoid region, is described in a well-defined group of cases as affecting the proximal colon and even the terminal ileum, the close association of the three conditions of regional enterocolitis, hyperplastic tuberculosis of the bowel, and idiopathic ulcerative colitis becomes even more apparent.

It is the purpose of this communication to examine a series of cases seen at Westminster Hospital during the past few years presenting as

various manifestations of non-specific enterocolitis and to attempt to determine whether or not any specific pathological differences may be demonstrated between them.

The group consists of 27 cases :—

Case 1 : A case of undoubted tuberculous ileitis.

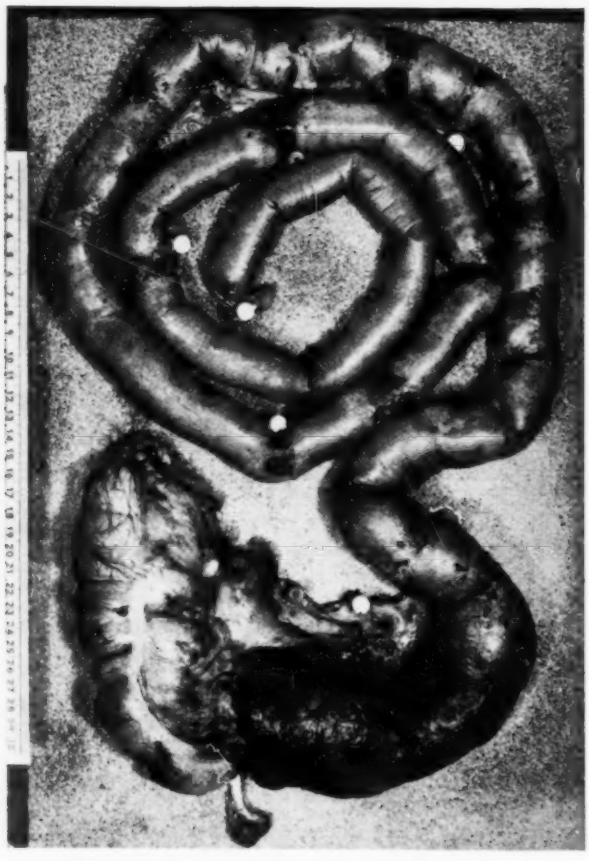

FIG. 336.—*Case* 1. Right hemicolectomy specimen showing tuberculous strictures at intervals along the ileum, and an area of secondary infection in the terminal ileum.

Case 2 : A case of undoubted hypertrophic tuberculosis of the cæcum.

Case 3 : A case of regional ileitis.

Cases 4, 5 : Two cases of ulcerative colitis of rectosigmoid region.

Cases 6–11 : Six cases where the entire colon was involved with disease.

Case 12 : A case where regional disease occurred in the colon and subsequently, after partial colectomy, affected the ileum.

Cases 13–15 : Three cases of regional disease affecting the colon only.

Cases 16, 17 : Two cases of regional disease affecting the ileum which subsequently, after operation, affected the colon.

Cases 18–25 : Eight cases of regional disease affecting the ileocæcal region.

Cases 26, 27 : Two cases of carcinoma of the colon included to demonstrate certain interesting features.

It is seen at once that *Cases* 1–5 represent typical examples of tuberculosis, regional ileitis, and ulcerative colitis, and, in view of the large literature already available, they may be dismissed briefly.

CASE HISTORIES

Case 1.—G. C., a female, aged 25 years, under the care of Dr. C. J. Gavey, was seen in December, 194 , when she gave a history of poor appetite, constipation, low abdominal pain, and occasional pyrexial attacks of one year's duration. A mass was discovered in the right iliac fossa, and a quiescent tuberculous lesion at the right apex was discovered on radiography. A right hemicolectomy was performed by Sir Stanford Cade in February, 1949 (*Fig.* 336). Scattered at intervals along the ileum were ulcers which encircled the bowel and showed tubercles on the serous surface. There were occasional serous tubercles in the cæcum, but no mucosal ulceration. In the terminal ileum, immediately proximal to the ileocæcal valve, there was an area of diffuse mucosal ulceration, the result of secondary infection. There was a group of fleshy lymph-nodes in the mesentery. The histological picture of the ileal ulcers and mesenteric lymph-nodes showed typical tuberculous changes, including endothelioid and giant cells together with considerable areas of caseation. Tubercle bacilli were cultivated from the intestinal tract. It is interesting to note that in the terminal ileum where secondary infection had supervened no giant-cell systems were found. Following the operation the patient was discharged, and since that time she has lost 1 st. in weight. An area of reactivation of lung tuberculosis was discovered by radiography six months ago, but this is now quiescent, and at the present time the patient is fit and well.

Case 2.—A. S., male, aged 30 years, under the care of Mr. G. T. Mullaly, was first seen in June, 1949, when he had intermittent attacks of abdominal pain for several weeks. On examination a mass was palpable in the right iliac fossa. On June 17 a right hemicolectomy was performed, and since that time the patient has been well and has gained weight. The operation specimen showed a hyperplastic condition of the cæcum with some mucosal ulceration and associated enlarged mesenteric glands (*Fig.* 337). Histologically both the bowel and lymph-nodes showed a picture typical of tuberculosis, with abundant caseation. Tubercle bacilli were cultivated from the intestinal tract.

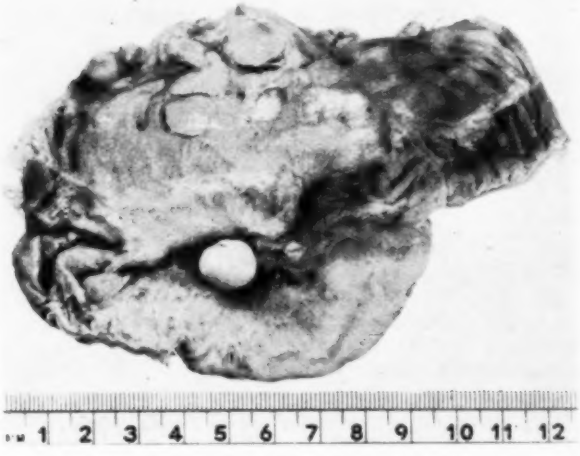

FIG. 337.—*Case* 2. Proliferation of the wall of the cæcum, showing a pea obstructing the bowel lumen.

Case 3.—E. B., a female, aged 30 years, under the care of Mr. R. W. Raven, gave a history of eight years of attacks of colicky abdominal pain unrelieved by appendicectomy five years previously. Radiographs revealed no chest lesion, but a barium follow-through showed a 'string' appearance of the terminal ileum. When examined in

August, 1949, a mass was palpable in the right iliac fossa and right hemicolectomy was performed. The specimen showed thickening of the wall and narrowing of the lumen

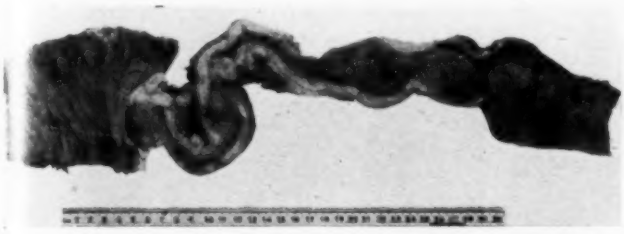

FIG. 338.—*Case* 3. Showing a regional hypertrophy with narrowing of the lumen and minimal mucosal ulceration of the terminal ileum.

of the distal 31 cm. of ileum, together with some superficial mucosal ulceration (*Fig.* 338), a change

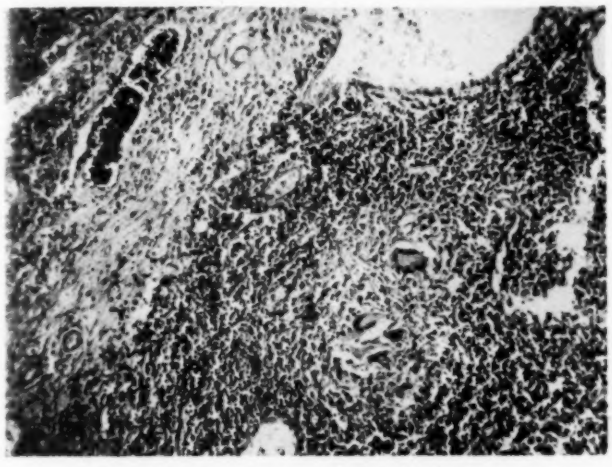

FIG. 339.—*Case* 3. Round, endothelioid, and giant-cell proliferation with some œdema in submucosa. (× 48.)

which stopped abruptly at the ileocæcal junction. There were several enlarged fleshy lymph-nodes in the adjacent

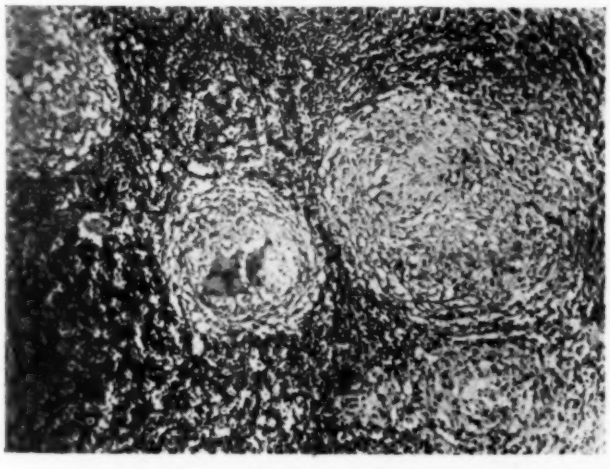

FIG. 340.—*Case* 3. Shows "punched-out" areas of endothelioid-cell proliferation and giant cells in a lymph-node. (× 48.)

mesentery. Histologically, submucous œdema, some muscle hypertrophy, generalized round-cell infiltration, and endothelioid and giant-cell proliferation without caseation were seen, whilst no tubercle bacilli were demonstrable (*Fig.* 339). The lymph-nodes showed sinus catarrh together with giant-cell systems of the type seen in the bowel (*Fig.* 340). The patient made an uneventful recovery and has been fit following operation.

Cases 4, 5.—*Case* 4 was a male, E. M., aged 52 years, who was under the care of Dr. E. R. Cullinan; *Case* 5, D. C., male, aged 15 years, under the care of Mr. A. Lawrence Abel.

These two cases are examples of ulcerative colitis remaining localized in the rectosigmoid region. *Case* 4

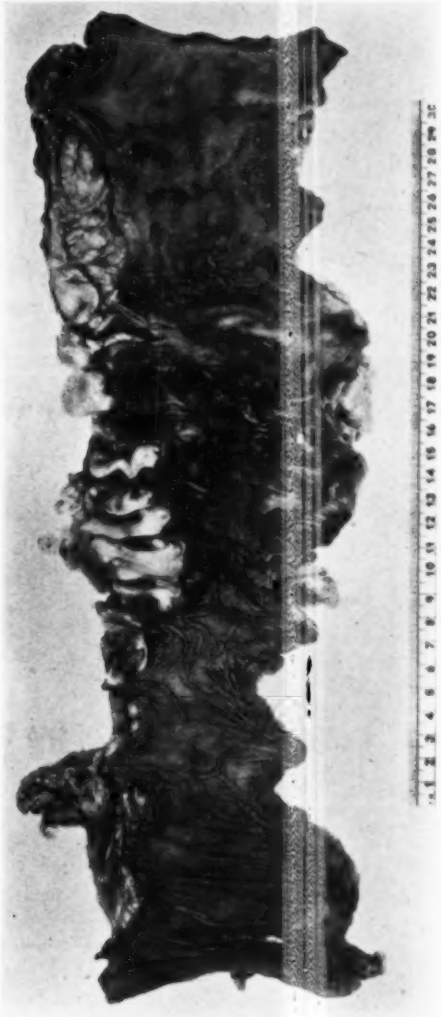

FIG. 341.—*Case* 4. Shows thinning and 'pseudopolyposis' in a case of chronic ulcerative colitis.

gave a history of 30 years' chronic diarrhœa with exacerbations, during which blood and mucus were passed. Terminally operative procedures were attempted, but the patient was too ill to stand any interference and died shortly afterwards. *Case* 5 had a short history of six weeks of violent diarrhœa with blood and mucus, progressing rapidly to death. The specimens from both cases at post-mortem showed proliferation of bowel mucosa between areas of ulceration (pseudopolyposis) confined to the rectosigmoid region of the colon (*Fig.* 341—*Case* 4). The histological picture showed submucous œdema and round-cell infiltration without giant cells in *Case* 5 (*Fig.* 342) and fibrosis with round-cell infiltration associated with thinning of the bowel wall in the more chronic *Case* 4 (*Fig.* 343).

Cases 6–11.—*Case* 6, E. B., male aged 33 years, under the care of Mr. G. T. Mullaly; *Case* 7, W. P., female aged 34 years, under the care of Sir Stanford Cade; *Case*

FIG. 342.—*Case* 5. Round-cell infiltration, lymph stasis, and œdema. (× 48.)

8, G. F., female aged 35 years, under the care of Mr. A. Lawrence Abel; *Case* 9, W. H., male aged 51 years, under the care of Mr. E. Stanley Lee; *Case* 10, A. C., female

FIG. 344.—*Case* 9. Masked thickening and stenosis of sigmoid colon in case of chronic ulcerative colitis.

aged 32 years, under the care of Mr. A. Lawrence Abel; *Case* 11, J. S., female aged 33 years, under the care of Sir Stanford Cade.

All these cases had long histories, covering severa years, of chronic diarrhœa with exacerbations, during which the passage of blood had occurred. Following

FIG. 343.—*Case* 4. Diffuse fibrosis of bowel wall. (× 48.)

prolonged medical treatment and in some cases ileostomy, colectomy was performed. The specimens so obtained showed two principal changes macroscopically. One was diffuse thickening of the bowel wall (*Fig.* 344) and the other, in the most chronic cases, was the presence of areas of thinning (*Fig.* 341). Mucosal ulceration with pseudopolyposis of the remaining mucosa was seen in all cases. Histologically the thickening was produced largely by œdema similar to that seen in *Case* 3, together

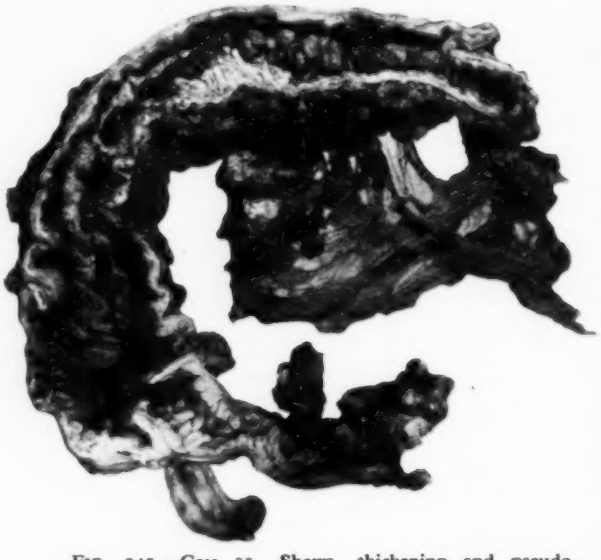

FIG. 345.—*Case* 11. Shows thickening and pseudo-polyposis in a right hemicolectomy performed as a first stage of total colectomy in chronic ulcerative colitis. (Cf. *Fig.* 352.)

with some fibrosis and muscle hypertrophy. Thinning appeared to be a terminal result of fibrosis and subsequent stretching. In all cases an intense round-cell proliferation was found, with numerous eosinophilic polymorphonuclear leucocytes, and in *Cases* 9 and 11 well-marked systems of giant and endothelioid cells were found in the bowel and adjacent lymph-nodes. In *Case* 11 the histological picture was identical with that of *Case* 3—the example of typical regional ileitis (*Figs.* 345, 346). In *Case* 6 well-marked submucosal lymph follicle

ormation was seen (*Fig.* 347). In *Case* 7 the patient ad active pulmonary tuberculosis—a well-recognized ssociated condition in ulcerative colitis—from which

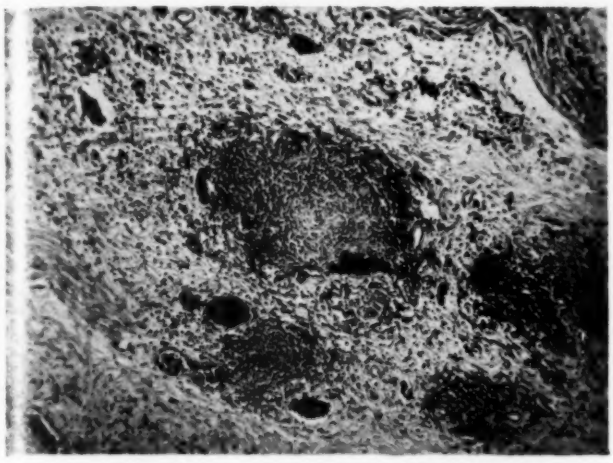

FIG. 346.—*Case* 11. Round and endothelioid cell proliferation with commencement of giant-cell formation together with tissue œdema and plugging of dilated lymphatics with round cells. (× 48.)

she eventually died one year following colectomy. In all these cases the entire colon was affected when available for study and also in all cases the process had commenced in the rectosigmoid region and had later affected the more proximal areas of colon.

Case 12.—B. M., male, aged 34 years, under the care of Mr. A. Lawrence Abel, was first seen in July, 1937, when he gave a history of appendicectomy in December, 1936, and acute intestinal obstruction relieved by enemata in May, 1937. On examination he had a mass in the right iliac fossa, and right hemicolectomy produced a specimen showing thickening and narrowing of the cæcum with some mucosal ulceration, together with a mass of enlarged fleshy lymph-nodes. Distal ileum and ascending colon were normal. Histology of the cæcum revealed submucous œdema and early fibrosis with some irregular muscle hypertrophy, generalized round-cell infiltration, and collections of endothelioid and giant cells, but no caseation or evidence of tubercle bacilli. The lymph-nodes showed sinus catarrh and some endothelioid-cell proliferation without caseation. Radiography of the chest at this time and subsequently was normal. The patient remained well for five years until in 1942 attacks of abdominal pain returned, which continued until in February, 1949, a severe attack associated with obstruction occurred. In November, 1949, a second operation was performed, during which 40 in. of ileum were removed. Since this time the patient has been fit and well. The specimen revealed a series of regional cicatrizing lesions encircling the bowel and narrowing the lumen. Mucosal ulceration was minimal and in most areas absent (*Fig.* 348). The intervening bowel wall was normal. Histology showed submucosal œdema, some fibrosis, and diffuse round-cell infiltration with follicle formation. Clumps of proliferated endothelioid cells and occasional giant cells were seen, but no caseation or tubercle bacilli were demonstrated.

Cases 13–15.—*Case* 13, W. H., female, aged 29 years, under the care of Mr. F. d'Abreu; *Case* 14, P. C., male, aged 27 years, under the care of Mr. G. T. Mullaly; *Case* 15, H. B., female, aged 72 years, under the care of Mr. Stanley Aylett.

All three of these cases had lesions confined to the colon. In *Cases* 13 and 14 the cæcum and ascending colon was affected, and in *Case* 15 the sigmoid colon was involved. In all cases a history of diarrhœa with blood and mucus in the stools was given, associated with some loss of weight

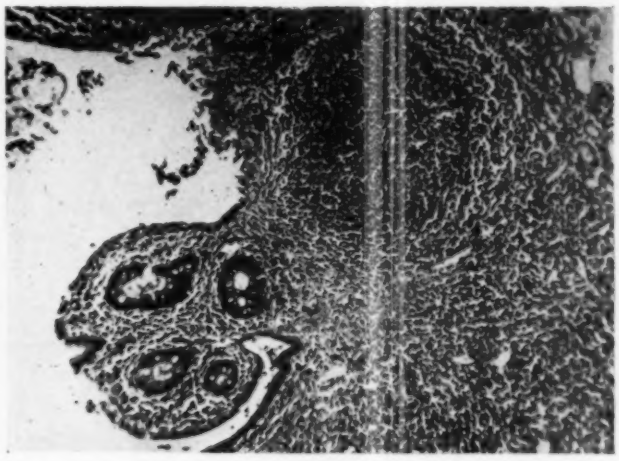

FIG. 347.—*Case* 6. Submucous follicle formation in colon. (× 52·5.)

and attacks of abdominal pain. Only in *Case* 14 was a mass palpable—in this case in the right iliac fossa. Right hemicolectomy was performed in *Cases* 13 and 14,

FIG. 348.—*Case* 12. Regional strictures in ileum following a hypertrophic lesion of cæcum and ascending colon.

and in *Case* 15 a local excision of a length of sigmoid colon was performed. Repeated examinations for tubercle

bacilli were negative in all these cases and X-ray findings in the chest were normal. The specimens from *Cases* 13 and 14 showed diffuse thickening of the wall of the cæcum and ascending colon, with narrowing of the lumen,

FIG. 349.—*Case* 14. Localized zone of thickening and lumen narrowing confined to the cæcum.

some mucosal ulceration, and numerous fleshy lymph-nodes (*Fig.* 349, from *Case* 14). *Case* 15 showed a localized area of thickening and narrowing of the bowel, with no ulceration (*Figs.* 350, 351). The histological

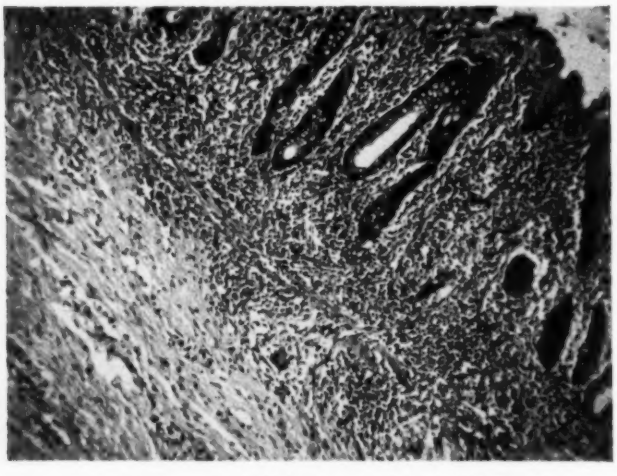

FIG. 351.—*Case* 15. Submucous round-cell infiltration showing a giant-cell system in colon. (× 48.)

picture in all these cases was identical with the appearances described in *Cases* 3 and 12. In *Cases* 13 and 15 operation was followed by improvement and these patients are alive and well. The subsequent history of *Case* 14 deserves special comment. Intermittent diarrhœa had continued, and attacks of pain with loose stools containing blood and mucus occurring during times of stress had manifested themselves. In short, a clinical picture of chronic ulcerative colitis now exists.

Cases 16, 17.—*Case* 16, B. P., female, aged 17 years, under the care of Mr. Stanley Aylett; *Case* 17, J. R., male, aged 26 years, under the care of Mr. G. T. Mullaly

FIG. 350.—*Case* 15. Localized zone of thickening and lumen narrowing confined to the sigmoid colon.

Both these patients gave histories of diarrhœa, abdominal pain, and some loss of weight over several years, culminating in right hemicolectomy following the demonstration of lesions affecting the terminal ileum and cæcum. In *Case* 16 this was followed by a two-year period free from symptoms, and then a return of pain and diarrhœa ultimately leading to intestinal obstruction occurred. Total colectomy was performed and the specimen is seen in *Fig.* 352. In *Case* 17 abdominal pain and intermittent diarrhœa and constipation continued after the right hemicolectomy, and three years later, in 1947, it was found that the left side of the colon was affected by the disease. In May, 1948, a pericolic abscess developed, which was drained and a length of sigmoid colon was resected. The patient died one month later as a result of toxæmia and peritonitis and at post-mortem no residual bowel disease was found. The macroscopical and microscopical appearances of these specimens showed features similar to those described in *Cases* 3, 11, 12, and 13–15 (*Fig.* 353).

Cases 18–25.—*Case* 18, V. P., female, aged 30 years, under the care of Mr. G. T. Mullaly; *Case* 19, B. B., male, aged 20 years, under the care of Mr. F. d'Abreu; *Case* 20, R. S., male, aged 22 years, under the care of Sir Stanford Cade; *Case* 21, K. S., male, aged 27 years, under the care of Sir Stanford Cade; *Case* 22, V. M.-D., female, aged 32 years, under the care of Sir Stanford Cade; *Case* 23, D. K., female, aged 23 years, under the care of Mr. F. d'Abreu; *Case* 24, G. B., male, aged 40 years, under the care of Mr. G. T. Mullaly; *Case* 25, W. W., male, aged 42 years, under the care of Sir Stanford Cade.

These patients are grouped together because all showed proliferative and cicatrizing lesions in the ileo-cæcal region (*Fig.* 354, *Case* 19). With the exception of *Case* 18, which presented as acute appendicitis, all these

p tients had several years' history of abdominal pain, d rrhœa, and loss of weight. In *Cases* 19, 22, and 24 a m ss was palpable in the right iliac fossa and, in all, signs o narrowing in the affected region of the bowel were seen o X-ray examination. In *Case* 21 a vesicocolic fistula had o urred. No evidence of tuberculosis was found either i the chest, or by attempted isolation of the organisms

FIG. 352.—*Case* 16. Hypertrophy and pseudopolyposis in colon following a regional lesion in the ileocæcal region. (Cf. *Fig.* 345.)

from stools or operation specimens. Right hemicolectomy was performed in all the patients except *Case* 23, who died before treatment could be effected. Following operation *Cases* 18-20 and 24 have been quite fit, with no recurrence of symptoms for periods of one year, one and a half years, two and a half years, and three years respectively. *Cases* 21 and 22 have continued with intermittent diarrhœa, the former case, a student, notes that times of stress, particularly when preparing for examinations, increased the diarrhœa, whereas the latter suggests that certain foods—in particular milk—precipitate attacks. *Case* 23 gave a history of five years' intermittent diarrhœa until her mother died six months before she came to hospital. At this time she became very much worse, with fluid stools containing some blood twelve to fourteen times a day. When she was admitted to hospital a mass was palpable in the right iliac fossa and a right ischiorectal abscess was found. Her condition was one of extreme toxæmia with subacute intestinal obstruction. An ileostomy was performed but her condition steadily deteriorated and she died. This girl was of extremely hysterical type, with a marked tendency to weeping apparent before her serious terminal state. At post-mortem a localized lesion of the ileocæcal region was found, causing thickening and stenosis of the bowel with mucosal ulceration and surrounding inflammatory reaction. A sinus led from the terminal ileum to the retroperitoneal tissues and tracked downwards to point in the right ischiorectal fossa, thus producing the abscess described above. The psychological associations

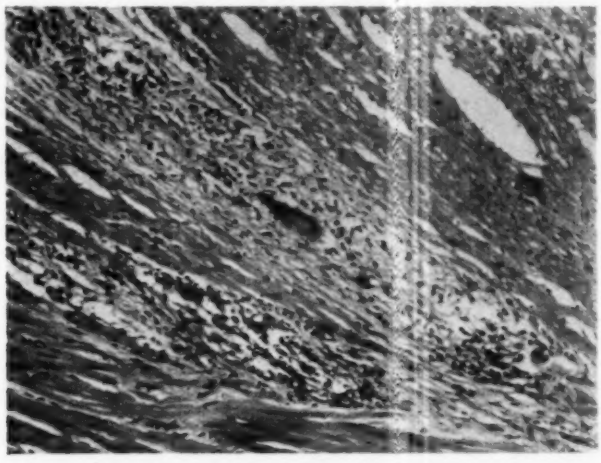

FIG. 353.—*Case* 16. Round-cell infiltration and œdema of muscle layer with giant-cell formation. (× 67·5.)

in *Cases* 21 and 23 are of some interest when compared with *Case* 14 and correlated with the condition of idiopathic ulcerative colitis where such phenomena form an essential feature of the clinical picture of the disease. *Case* 25 also deserves special comment. First seen in April, 1949, he gave a history of two years' colicky abdominal pain, diarrhœa, and some vomiting. On admission he had acute intestinal obstruction, and at laparotomy a localized cicatrizing lesion of the terminal

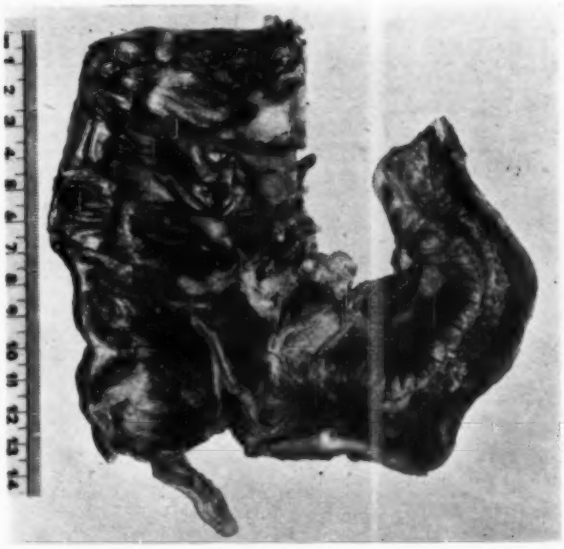

FIG. 354.—*Case* 19. Ileocæcal lesion showing thickening of ileal wall and early pseudopolyposis in cæcum.

ileum and cæcum was found. A right hemicolectomy was performed and the specimen showed thickening of the wall of the terminal ileum, cæcum, and proximal ascending colon, with mucosal ulceration and a number of enlarged soft lymph-nodes in the mesentery. Following operation the patient was well for nine months, when he again began to have abdominal pain and diarrhœa. When re-admitted he was showing signs of subacute bowel obstruction, but this time he had a fever of

101–103° F. and a leucocyte count of 20–30,000 per c.mm. with 20 to 23 per cent eosinophils. On his previous admission he had been apyrexial and had a normal leucocyte count. At laparotomy the bowel appeared normal, but a large irremovable retroperitoneal mass was found spreading forward to obstruct its lumen. The patient went rapidly downhill and died of toxæmia as a result of his bowel obstruction. At post-mortem no remaining lesion was found in the bowel, but a large glandular mass arising from the cœliac and para-aortic regions, and also along the iliac vessels, was found. No other abnormalities were discovered, except in the lungs, where generalized terminal œdema and scattered small indurated zones were found. Histologically these latter showed fibrosis, œdema, necrosis, and obliterated alveolar pattern, with thickened elastic bands lying in the stroma (*Fig.* 355). There were no accumulations of eosinophils. The histology of the hemicolectomy specimen showed submucous œdema with an intense infiltration of the submucosa and muscle layers by round cells, including large numbers of eosinophils (*Fig.* 356). Groups of proliferated endothelioid cells, but no giant cells, were seen. Lymph stasis was marked in the subserosal vessels. The lymph-nodes showed extensive sinus catarrh (*Fig.* 357). The post-mortem specimens of lymph-nodes showed breaking down necrotic areas and replacement of normal architecture by round-cell proliferation in which the predominant cell was the eosinophil (*Fig.* 35). The histological pictures of the other cases followed the general pattern of œdema, fibrosis, and round-cell infiltration. Only in *Cases* 18 and 22—both cases with relative short histories—were endothelioid and giant cells numerous, whereas in the more chronic cases they were not a feature. In *Case* 23 deep slits penetrating from the mucosa to the muscle layer were evident, together with a dense round-cell infiltration with no giant cells.

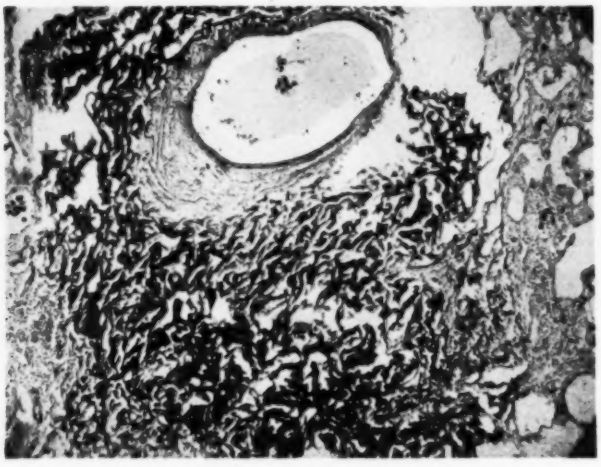

FIG. 355.—*Case* 25. Fibrosis in lung with irregular elastic bundles. (× 135.)

FIG. 356.—*Case* 25. Intense round-cell infiltration of bowel wall. A proliferated vessel can be seen. (× 48.)

Cases 26, 27.—*Case* 26, J. L., female, aged 58 years, under the care of Mr R. W. Raven ; *Case* 27, C. D., male, aged 50 years, under the care of Mr. R. Cox.

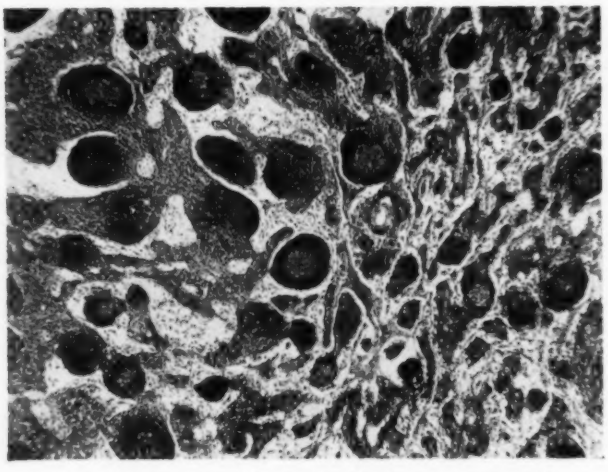

FIG. 357.—*Case* 25. Intense lymphœdema in mesenteric lymph-node at time of operation. (× 6.)

FIG. 358.—*Case* 25. Zone of necrosis in lymph-node at autopsy. (× 48.)

Both these cases were examples of carcinoma of the colon, *Case* 26 in the descending colon and *Case* 27 in the cæcum. They are included because in both there were associated lesions of the type under discussion. In *Case* 26 in the subserosa adjacent to the carcinoma there was evidence of distended lymph-channels together with endothelioid and giant-cell proliferation. In *Case* 27 the terminal ileum was narrowed and its wall somewhat thickened, whilst microscopy revealed submucous œdema, lymph stasis, and intense round-cell proliferation with follicle formation, but no giant cells. In both cases lymph-nodes of the area showed intense sinus catarrh but no metastases.

ANALYSIS OF CASES

Much has been written in the literature concerning the clinical differences of the types of cases outlined above, but in analysing this particular series certain general points become apparent. From the clinical standpoint they are patients with intermittent diarrhœa and colicky abdominal pain, with a tendency to exacerbations during which blood and mucus may be passed. This latter feature is almost constant in those cases where the colon is affected. Obstruction of the bowel as a result of narrowing of the lumen is common. A tendency to secondary inflammatory reactions which may lead to abscess, sinus, or fistula formation is observed (*Cases* 17, 21, and 23). Chronicity is the rule, but violent cases leading to rapid death occur (*Cases* 5 and 22).

When the right side of the colon or terminal ileum is involved surgical measures seem to be of more value, and Bockus (1944) suggests affection of this area as an indication for the consideration of surgery, when listing the indications for operation in ulcerative colitis. In the treatment of regional enterocolitis or hypertrophic tuberculosis it is generally considered to be the treatment of choice.

Whilst it would be dangerous to draw concrete conclusions from a small selected series such as this, most observers would agree that from the clinical point of view the syndromes represented merge closely into one another and present in many cases pictures which defy distinction one from another.

Ravdin and Johnston (1939), having reviewed the literature, suggested that the differential diagnosis of regional enterocolitis from hypertrophic tuberculosis can be made only by a failure to demonstrate tubercle bacilli, whilst ulcerative colitis is distinguished by its tendency to affect the distal colon. They go on to say: "However, in those forms of ulcerative colitis involving only the proximal parts of the colon, clinical diagnosis is impossible." Bockus expresses essentially the same views.

One turns, therefore, to the morbid anatomical and histological appearances in an attempt to define essential differences.

Pathology.—The first feature which is striking when considering the morbid anatomy of these lesions, is the region of the bowel affected. Cases fall into groups as have been described above, and can be summarized as :—

1. Those cases confined to the distal colon.
2. Those cases commencing in the distal colon and spreading proximally.
3. Those cases localized in a region of the colon.
4. Those cases commencing in the terminal ileum and spreading distally.
5. Those cases localized in a region of the ileum, usually terminally.

It may be seen at once that cases in groups 1 and 5 present clear-cut differences, whereas in groups 2, 3, and 4 there is so much overlap that unless some very definite individual characteristics existed they would be difficult to distinguish.

When one examines the cases, however, such characteristics are hard to find. On the contrary, striking similarities exist. Thus Taylor (1945) was unable to find any differences in the cases of hypertrophic tuberculosis and regional ileitis which he studied, and came to the conclusion that both were caused by the tubercle bacillus.

Sneierson and Ryan (1941), in reporting 22 cases of regional enterocolitis and reviewing the literature, were of the opinion that they were dealing with a non-specific inflammatory lesion indistinguishable from other inflammatory lesions. Palmer, Harman, and Ricketts (1945) expressed similar views.

In the cases presented here the similarities seem best described as follows :—

MACROSCOPICAL CHANGES.—

Site.—The site of the lesions has already been discussed, and it is evident that this consideration alone does not supply a characteristic feature.

Appearance.—The important appearances of the lesions seem to be :—

a. Thickening of bowel wall.

b. Narrowing of the lumen.

c. A smooth 'lumpy' appearance of the mucosa with tendency to ulceration and, in the colon, to 'pseudopolyposis'.

d. In the late stages a tendency for the bowel wall either to become thinned, or for an inflammatory reaction to occur around it, with abscess, sinus, or fistula formation.

None of these features can be said to be in any way specific, and in the cases of this group they were seen indiscriminately throughout the bowel.

Thus the picture of 'pseudopolyposis' in *Case* 16 (*Fig.* 352), where regional disease in the terminal ileum causing thickening and stricture had reappeared in the transverse colon following operation, is identical with that seen in *Case* 11 (*Fig.* 345) where the disease was confined to the colon and presented clinically as a typical case of ulcerative colitis.

The regional ileal strictures in *Case* 12 (*Fig.* 348), where colon thickening and ulceration of ulcerative colitis type was followed after operation by small-bowel disease in which no evidence of tuberculosis could be found, bear striking resemblance to the tuberculous ulceration of *Case* 1 (*Fig.* 336).

Case 2 (*Fig.* 337), of proven hypertrophic tuberculosis, is identical in appearance with *Case* 14 (*Fig.* 349), where no evidence of tuberculosis existed.

Further analysis of the cases along these lines clearly offers numerous other similar comparisons.

MICROSCOPICAL CHANGES.—In cases of proved tuberculosis it is superfluous to discuss the histological picture as it is, of course, typical of the disease. The well-known fact may be stressed, however, that in tuberculosis of hypertrophic type giant cells and caseation may be minimal or even absent, whilst in cases where secondary infection has occurred giant-cell systems may be obliterated (*Case* 1).

Accounts of the histological picture in ulcerative colitis are somewhat meagre as operative specimens from such cases are relatively few in number, and are usually obtained only when the right side of the colon is involved, whilst post-mortem specimens show terminal events and frequently the picture is confused by advanced post-mortem changes. Most authors are agreed, however, that the features of the condition are submucosal œdema with some mucosal hyperplasia, necrosis, and ulceration, associated with diffuse round-cell infiltration including eosinophils, and in the later stages advancing fibrosis (*Figs.* 342, 343).

Regional disease has been most carefully described by Hadfield (1939), although his account was confined to the disease as it affects the terminal ileum. His chief conclusions have already been stressed. From the histological point of view his most important observations are: (1) Endothelioid and giant-cell proliferation; (2) Lymph stasis.

Changes of a similar type to those described by Hadfield in the terminal ileum were found in this series of cases in the colon (*Cases* 11 and 13–15) (cf. *Figs.* 339, 340 with *Figs.* 346, 347, 351). Such cases have been described in the literature as

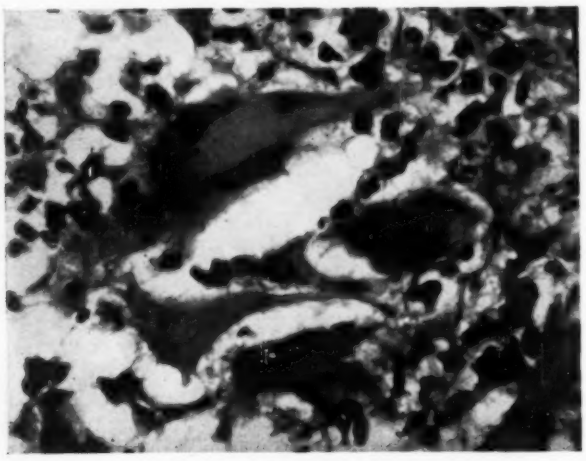

FIG. 359.—*Case* 11. Typical giant cells in case when no tuberculosis was found. (× 270.)

examples of regional enterocolitis, or sometimes as chronic ulcerative colitis of regional type, although it may be noted that in *Cases* 9 and 11 the entire bowel was affected and the cases were clinically typical diffuse ulcerative colitis.

Certain microscopical features may be discussed under the following headings:—

Giant Cells.—Much has been written on the significance of the giant cells. Thus Sneierson and Ryan (1941) suggest that they are purely coincidental findings, whilst Castleman (1944) states that they provide the only important differential feature between regional enterocolitis and ulcerative colitis. Some authors, such as Ginzburg and Oppenheimer (1933), have considered that the giant cells are of foreign-body type occurring around particles of vegetable debris, a view which cannot be upheld as a result of the study of the cases described here. Taylor (1945), on the other hand, considers these cells to be part of a tuberculous manifestation (*Fig.* 359).

Hadfield has stressed that in long-standing cases secondary lymphadenitis leads to obliteration of the giant-cell picture and replacement by a non-specific round-cell infiltration.

In this series giant- and endothelioid-cell proliferation was found in *Cases* 1 and 2 where tuberculosis was proved, in *Case* 3 where disease was confined to the terminal ileum, in *Cases* 9 and 11 and 13–15 where the disease was confined to the colon, in *Case* 12 where regional disease in the ileum followed disease in the colon, in *Cases* 16 and 17 where regional disease in the colon followed disease in the terminal ileum, and in *Cases* 18 and 22, two of the eight cases where disease was found in the ileocæcal region.

It is clear, therefore, that this particular histological picture can appear in all areas of the bowel, and it is striking to observe identical histological appearances in *Cases* 9, 11, and 3, the first a typical case of ulcerative colitis clinically, with no lesions in the ileum, and the third a classical case of regional ileitis.

Lymph Stasis.—Lymph-channel dilatation with stasis and tissue œdema was a more or less constant feature in all the cases examined (*Figs.* 339, 340, and 357). It occurred equally commonly in the colon and in the ileum. Enlarged fleshy lymph-nodes showing intense sinus catarrh were found in the majority of cases.

It is interesting to notice in *Case* 27 a case of carcinoma of the cæcum where œdema, lymphoid hyperplasia, and round-cell infiltration had occurred in the terminal ileum with marked evidence of lymph stasis and sinus catarrh in the adjacent lymph-nodes. It seems reasonable to suppose that the ileal changes here were purely non-specific, arising as a result of stasis in the draining lymph-channels. In *Case* 26, also a case of colon carcinoma, lymph stasis in the subserosa was marked, and in this case occasional clumps of endothelioid and giant cells were seen.

Taylor (1945) has suggested that tuberculosis produces hypertrophic lesions in the bowel as a result of lymphatic invasion and subsequent stasis, whilst Bargen and Dixon (1935), and Jackson (1937), felt that mesenteric lymphadenitis was related to terminal ileitis and that both conditions are diseases of the lymphatic system.

Probstein and Greenfield (1936) felt that lymphatic vessel stagnation was in some way causative of regional enterocolitis, and point to the abundance of lymphatic tissue and the tendency to stagnation in it as a possible reason for the frequency with which the ileocæcal angle is affected. Reichert and Mathes (1936) have produced interesting experimental evidence by causing lesions in animals somewhat similar to those found in regional enterocolitis by injecting irritative and sclerosing substances into the lymphatics.

It seems highly suggestive, therefore, that lymph stasis, whatever its background cause, may produce a histological picture of œdema, endothelioid, giant, and round-cell proliferation in the presence of hypertrophic and cicatrizing lesions in the bowel. These lesions may be identical histologically in the ileum and colon and appear associated with the clinical syndrome of ulcerative colitis and regional enterocolitis.

In searching for an aetiological background to account for changes such as have been described in this series of cases, numerous bacteria have been incriminated, but none have stood the test of repeated investigations. In the cases described here no organism seemed to be causative, with the exception of those cases where the tubercle bacilli was isolated; therefore this aspect will not be considered further.

Claims that bowel condition of ulcerative colitis type, associated with long-standing intermittent diarrhœa, might be produced as a result of allergic phenomena have been made repeatedly by Andreson

(1925, 1941, 1942, and 1949), but his studies have been entirely clinical. Gray and Walzer (1938) and Gray, Harten, and Walzer (1940), first in the rectum and then in the ileum and colon of colostomies, have studied the macroscopical changes in humans, observing intense œdema and excessive mucus secretion following ingestion of raw ground peanuts in patients where local areas of observable bowel had been made sensitive by previous intramucosal injections of human serum containing atopic reagin antibodies for peanut. No ulceration was observed in these experiments and the changes lasted one and a half to two hours before normality was regained.

Walzer, Gray, Straus, and Livingstone (1938) performed similar experiments in the bowel of Rhesus monkeys, and reported similar results of œdema associated on this occasion with mucosal erosions; they failed to find eosinophils in the mucus secreted from the surface, and histological descriptions were not given. There is some suggestion, therefore, that sensitization may play a part in the production of inflammatory lesions in the bowel, but clearly much more evidence is required before any dogmatic statement could be made.

The histological changes which are generally accepted as occurring in allergic states are briefly:—

1. Œdema.
2. Eosinophil production.
3. Fibrinoid degeneration.
4. Focal necroses.
5. Proliferation of the wall of small vessels frequently associated with necrosis and perivascular accumulation of round cells.

Many of these changes are seen in the conditions which have been described (*Figs.* 339, 343, 355, 356, and 358), but it is particularly difficult to dogmatize about their significance in the bowel, where eosinophilia and endarteritis are common when inflammatory conditions are present, particularly when there is any evidence of smooth muscle destruction. However, tissue eosinophilia was such a marked feature in *Case* 25 as to dominate the histological picture, and in this case there was also a well-marked eosinophilia in the peripheral blood. The focal necroses in the lymph-nodes in this case, in some areas amounting to large zones of cell death, are also seen in cases where sensitization plays a part. This phenomenon has been described in sulphonamide sensitization (Lederer and Rosenblatt, 1942) and also in the rare cases of fatal asthma (Smith, 1948; Lumb, 1950).

It is of some interest to correlate these observations with the facts demonstrated in this series of cases, where it has been shown that the changes in proved ileocæcal tuberculosis are so closely mimicked by those in regional enterocolitis and ulcerative colitis. Tuberculous changes are generally regarded as classical examples of an allergic state, and it is tempting therefore to suggest that other antigenic substances acting on the bowel might produce an essentially similar picture.

What does seem clear from studying the cases presented here is that those syndromes variously known as regional ileitis, regional enteritis, regional enterocolitis, regional ulcerative colitis, and chronic idiopathic ulcerative colitis do not exist as separate entities so much as varieties of an essentially similar process manifesting itself in different areas of the bowel from case to case.

SUMMARY

1. Clinico-pathological pictures of a group of ulcerating and cicatrizing lesions of bowel have been discussed.

2. The essentially similar clinico-pathological make-up of so-called regional enterocolitis and chronic ulcerative colitis has been stressed.

3. Certain aetiological factors, including the possibility of an allergic background, have been considered.

My grateful thanks are due to Professor R. J. V. Pulvertaft for much helpful advice; to the Medical and Surgical Staffs of the Westminster Hospital Group, where reference has been made to cases under their care; and to Dr. Peter Hansell, of the Department of Medical Photography at Westminster Hospital.

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GIANT HYPERTROPHIC GASTRITIS SIMULATING MALIGNANT DISEASE

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GIANT hypertrophic gastritis is a rare disease characterized by great thickening of the stomach wall over a wide area and by a striking resemblance of the rugæ to cerebral convolutions. The thickening is due mainly to hypertrophy of the mucous membrane, although the other coats of the stomach may also be thickened. The disease was first described in detail by Ménétrier (1888, a, b) under the name *polyadénome en nappe*. His account of it, based on 3 examples

FIG. 360.—Stomach, showing large irregular filling defects, especially along greater curvature.

found at necropsy, is contained in a comprehensive study of gastric polyadenoma published in two parts —a thoughtful and admirably written work that is still well worth reading. In 1943 Spriggs published a substantial paper on the same theme and described 12 cases of giant hypertrophic gastritis under the name *hypertrophic bulbous gastritis*, which he distinguished from the gastric hypertrophy sometimes associated with peptic ulcer or gastro-enterostomy. In 1947 Maimon, Bartlett, Humphreys, and Palmer found records of 12 further cases and reported 6 of their own, mentioning 4 others without describing them. Another case was reported by Bourne and Wood (1948) and in more detail, with a survey of the literature, by Forrester-Wood (1950). The total number of cases reported thus seems to be 38.

Giant hypertrophic gastritis does not produce a distinctive clinical picture, and if the history is short the condition may simulate carcinoma or lymph-sarcoma of the stomach. The correct diagnosis may suggest itself at laparotomy or on macroscopic examination of the specimen, but remains presumptive until confirmed by histological examination. In the case here described, most of the affected tissue was removed by partial gastrectomy and the rest of it disappeared without treatment in the course of a year—an observation of surgical importance, since it shows that total gastrectomy with its higher mortality is not essential for a successful result.

CASE REPORT

A male welder, aged 30, was admitted to Manchester Royal Infirmary in July, 1947, complaining of nausea, vomiting, and upper abdominal discomfort of eight weeks' duration. He said that he vomited small quantities of clear, colourless fluid once a day, always between 8 and 9 p.m. Old food residues and blood had not been noticed. Pain had been absent. His appetite had been poor recently and he had lost about 14 lb. (6 kg.) during the previous eighteen months. He had been constipated and had noticed blood-streaking of the stools from piles. In 1942 and 1946 he had both malaria and dysentery (probably not amœbic). The upper jaw was cleared of carious teeth during his army service, 1939–46, two years of which were spent in the infantry in Burma. On release he returned to his old occupation, spot and electric welding, from which he may have inhaled dilute caustic fumes. There were no relevant points in the family histories. He had two children, both in good health. He smoked twenty cigarettes daily and took a pint or two of beer at week-ends.

ON EXAMINATION.—The patient was of spare build and had obviously lost weight. The only abnormality found was a firm, well-defined tender mass about 4 in. by 2 in. in the epigastrium, emerging from under the left costal margin and moving with respiration. Succussion splash was elicited over the mass. On X-ray examination the stomach showed large irregular filling defects, which were attributed to extensive malignant disease (*Fig.* 360). A gruel test-meal without histamine showed excess mucus and achlorhydria, but the blood-count was normal and the Wassermann test negative.

AT OPERATION.—Laparotomy was performed in August, 1947. The stomach was enlarged, the peritoneal coat normal. Many enlarged discrete lymph-glands were present along both curvatures. The muscle coat seemed to be thickened. On palpation between the fingers, the stomach apart from the fundus was found to be filled with sausage-like swellings, which could be moved about to some extent inside it. The duodenum and gall-bladder were normal. There was no obvious hepatic or peritoneal metastasis and no free fluid. The condition was thought to be a diffuse polypoid carcinoma and high Moynihan gastrectomy was carried out. The mucosa at the line of section was thickened and friable, the submucosa œdematous.

THE SPECIMEN.—When the stomach was cut open, the mucosa was seen to be enormously thickened and thrown into fleshy folds up to 2·5 cm. in breadth, arranged haphazardly to give the appearance of a cerebral hemisphere. The rugæ varied in length up to 7·5 cm. and were confluent. The mucosa was hyperæmic but not ulcerated, and was covered with sticky mucus.

Histology.—Microscopical examination showed that the lesion was benign, and in paraffin sections stained with hæmalum and eosin the rugæ in cross-section

appeared as papillary projections of mucosa up to 1·8 cm. high (*Figs.* 361, 362). The epithelium covering the rugæ and lining the ducts of the glands consisted of tall

FIG. 361.—Greatly thickened stomach wall showing three giant rugæ in cross-section. (× 3.)

rectangular cells with colourless cytoplasm and small basal nuclei. The glands were composed of rounded cells with small central nuclei. About half these cells were eosinophil and accordingly identifiable as parietal

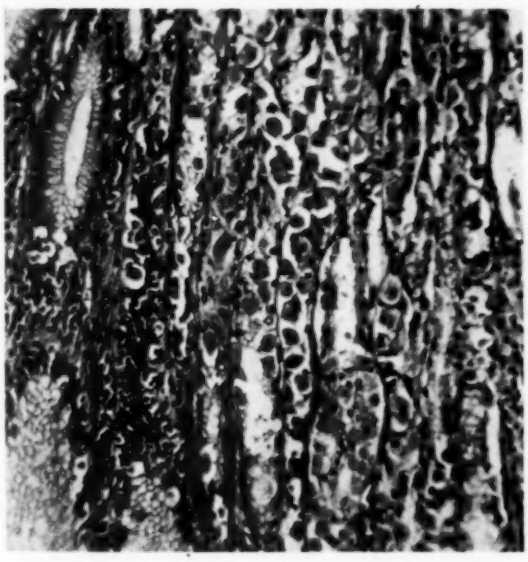

FIG. 363.—Left third of figure shows ducts lined by columnar epithelium; rest of figure shows glandular tissue composed mainly of parietal cells. (× 120.)

cells (*Fig.* 363). The other half were pale and not identifiable (*Fig.* 364); they may have been zymogenic cells or of the same nature as the cells forming the epithelium of the rugæ and ducts. The submucosa was heavily infiltrated with lymphocytes, plasma cells, and eosinophils; polymorphs were also present. The muscle coats were about 0·4 cm. thick, the total thickness of the stomach wall being up to 2·2 cm. There was no evidence of disease in the nerves or blood-vessels.

The paragastric lymph-glands showed the normal pattern, but the lymphoid follicles had large germ centres and the lymph cords were often widely separated by broad bands of sinus endothelium.

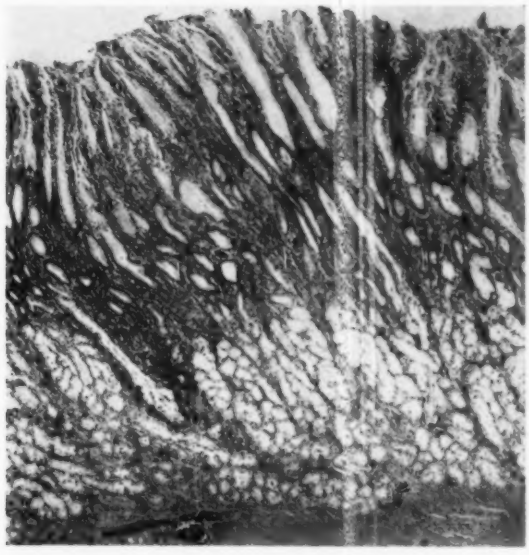

FIG. 362.—Mucosa of giant ruga. Upper half of figure shows ducts; lower half glands on connective-tissue base. (× 20.)

NATURE OF THE LESION.—The lesion was a diffuse hypertrophy of the rugæ, which may have been further enlarged by œdema. The leucocytic infiltration of the rugæ indicated chronic inflammation, which may have

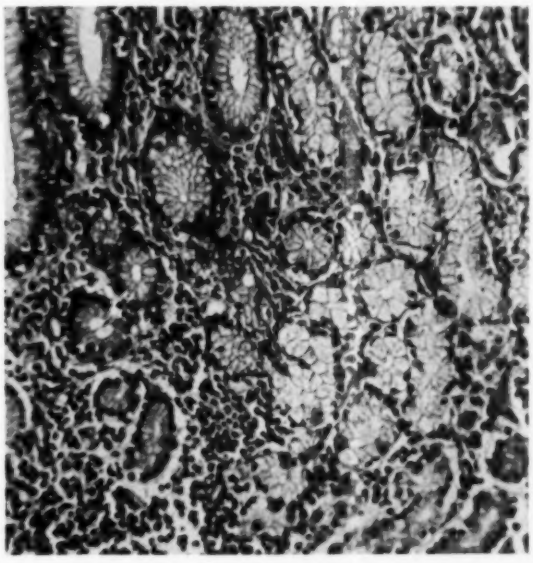

FIG. 364.—Left half of figure shows ducts, right half glandular tissue. The gland cells are mainly pale, but a few parietal cells (dark) are also present. Lower left corner shows dense leucocytic infiltration. (× 120.)

been due to infection or mechanical irritation. The inflammation would account for the prominence of the germ centres and of the sinus endothelium in the glands. One of Ménétrier's patients (1888, a, Obs. V) showed

enlargement of the intestinal as well as gastric mucosa, and the possibility that giant hypertrophic gastritis may be part of a general disorder of the alimentary tract is worth bearing in mind.

POST-OPERATIVE HISTORY.—The patient made a normal recovery from the operation and was discharged home on the fifteenth post-operative day. He resumed work and remained fit, but in view of the incomplete excision of the affected part of the stomach, he was re-admitted for investigation thirteen months after the operation. His appetite was good, and he had no digestive troubles apart from discomfort after a big meal. He had gained weight. The small portion of stomach remaining appeared normal both radiologically and gastroscopically. Achlorhydria was still present, but the blood-count and serum-proteins were normal, and no amœbæ or cysts were found in a fresh stool.

DISCUSSION

The cause of giant hypertrophic gastritis is unknown, although various agents have been considered as possible aetiological factors. Spriggs (1943) indicted alcoholism or sepsis in 6 of his cases, but there was no evidence of either in the other 6. Forrester-Wood (1950) thought that amœbiasis, which was present in his case, might be significant. Hypoproteinæmia has been mentioned by Maimon et al. (1947) and Forrester-Wood as a possible factor in causation; this finding, however, is just as likely to be due to impaired nutrition from the gastritis. There does not appear to be any constant factor in the histories of the patients, and the role (if any) of the various agents mentioned in producing or influencing the disease is unknown.

Giant hypertrophic gastritis may occur in adults of any age, and males are affected oftener than females. The length of history ranges from a few months to many years. The commonest symptom is epigastric pain or discomfort and this may be accompanied by other evidence of gastro-intestinal disorder—anorexia, nausea, vomiting, diarrhœa, or constipation. The pain does not follow a characteristic pattern; it is sometimes relieved by food, but this may make it worse.

Interference with nutrition may be manifested by weight loss, anæmia, and hypoproteinæmic œdema. A mass is rarely palpable. Filling defects will show on X-ray examination after an opaque meal; their smooth outline and mobility, and the elasticity of the underlying gastric wall may suggest the correct diagnosis. Confirmation of these findings may be obtained on gastroscopy. The acidity of the gastric secretion may be within normal limits, or histamine-fast achlorhydria may be present; cases with free HCl in the gastric juice when first seen may progress to achlorhydria over a period of years, and this deterioration may be accompanied by clinical improvement and diminution in the size of the rugæ. It is not known whether giant hypertrophic gastritis predisposes to carcinoma of the stomach, but the general opinion is that there is no special relation between the two conditions.

Treatment may be medical or surgical, according to circumstances. Spriggs treated his cases on medical lines for periods up to several years and found that the masses may disappear. When treatment was interrupted, symptoms returned, and from this he concluded that the regression of the mass was influenced by the treatment and not spontaneous. The most helpful element in the treatment seems to have been daily gastric lavage with a pint of water containing a teaspoonful of sodium bicarbonate, which relieved the discomfort due to excessive secretion of mucus.

Gastrectomy—partial or total— is indicated when the combination of a palpable abdominal mass, achlorhydria, filling defect after an opaque meal, weight loss, and anæmia points strongly to malignancy, or when symptoms or nutritional disturbance are severe. Gastrectomy also offers the prospect of immediate removal of symptoms and a speedy return to normal life—two great advantages over medical treatment with its strict and tedious régimen and its powerlessness to prevent the recurrence of discomfort. At laparotomy, the feel of the stomach between the fingers is highly characteristic and will strengthen the pre-operative impression or suggest the diagnosis of giant hypertrophic gastritis if the possibility is borne in mind. On theoretical grounds, total gastrectomy is indicated when the stomach is diffusely involved, because it ensures complete extirpation of affected tissue. Partial gastrectomy is a less formidable undertaking, with a lower operative mortality, and post-operative feeding difficulties are less. Our own case is of interest in showing that incomplete removal of the affected mucosa may be followed by spontaneous regression of the portion left behind.

SUMMARY

Giant hypertrophic gastritis simulating malignant disease in a man of 30 is described. Most of the affected tissue was removed by partial gastrectomy and the portion left behind disappeared without treatment in the course of a year.

The nature of the condition was recognized only on microscopical examination of the excised tissue, which showed the usual benign giant hypertrophy of the mucosa.

Giant hypertrophic gastritis is among the conditions that should be considered in the differential diagnosis of diffuse gastric neoplasms. It is possible to arrive at a correct diagnosis by the full use of modern methods of investigation.

Some recorded cases of giant hypertrophic gastritis have been successfully treated on medical lines, but surgery offers the prospect of immediate removal of symptoms and a speedy return to normal life.

We are indebted to Dr. C. S. D. Don for the gastroscopic examination; to Dr. E. R. A. Cooper for advice on the sections; and to Professor S. L. Baker for reading the manuscript. Our thanks are due to Dr. Duncan Menzies for the radiograph, and to Mr. F. Ward for the photomicrographs.

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A CASE OF EOSINOPHILIC GASTRITIS

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THE following case of dyspepsia and hæmatemesis due to eosinophilic gastritis is reported because of its rarity. We have found only three similar reports in the literature.

CASE REPORT

CLINICAL HISTORY.—The patient, J. C., aged 39, was the son of a British soldier serving with the Indian Army, and spent all his early life in India. In 1932 he was an in-patient in the Military Hospital, Rawalpindi, for six weeks with 'dysentery' and was given a course of emetine, following which the condition cleared up completely and has not recurred.

He first developed dyspeptic symptoms in March, 1947, when he complained of epigastric discomfort and flatulence, the onset of which was quite unrelated to his meals and was unrelieved by alkalis or by taking food. His symptoms came on at variable times during the day and night, and on occasions he suffered from a more severe type of pain located diffusely over the upper abdomen. There was no vomiting, but some failure of appetite. On palpation tenderness was elicited in the upper abdomen a little to the right of the midline half-way between the xiphoid process and the umbilicus. The descending and iliac colon were distinctly palpable. Physical examination was otherwise quite negative, and at no time was there any pyrexia. Symptoms persisted for some months without remission, and during this period a full investigation was carried out.

Gastroscopy on Aug. 27 showed a rugose and mammillated gastric mucosa, without ulceration.

Barium-meal Radiography on Oct. 23 showed no excess of resting secretion, but quite definite rugal hypertrophy, particularly in the pyloric antrum. There was slight delay in the filling of the duodenum, but no evidence of gastric or of duodenal ulcer.

The patient's dyspepsia persisted and he was under constant supervision in the Medical Out-Patient Department. In November, 1948, a year and a half after the first onset of symptoms, he had a sudden severe hæmatemesis necessitating blood transfusion of 3 pints. The severity of the blood-loss was indicated by the hæmatological picture, which at this time was as follows :—

Blood-count :—	
Hæmoglobin	6·0 g. (41 per cent)
R.B.C.'s	1·9 million
Colour index	1·08
Total white cells	8000
Polymorphonuclears	70 per cent
Lymphocytes	28 per cent
Monocytes	1 per cent
Eosinophils	1 per cent

Further investigations were carried out as soon as his condition had improved sufficiently.

Barium meal on Nov. 23, 1948, showed no evidence of peptic ulceration either in the stomach or duodenum, but, as in the previous X-ray examination, there was gross hypertrophy of the rugæ of the stomach. Particular attention was directed to the lower end of the œsophagus, but the presence of varices in this region could not be made out.

Gastroscopy on Nov. 14 showed precisely the same appearance as on the previous examination, the prominent mucosal pattern being as obvious as ever.

Œsophagoscopy : No œsophageal varices seen.

Wassermann and Kahn Reaction : Negative.

Blood-urea : Varied between 26 and 47 mg. per cent on different occasions.

Test-meal : Showed hypo-acidity (*Fig.* 365).

After this attack of hæmatemesis the patient was completely free of symptoms for seven weeks, after which the pain returned and became more persistent. Following a recurrence of hæmatemesis and melæna in August, 1949, he was referred to the surgical unit with a view to exploration of the abdomen on account of the repeated severe hæmorrhages in the absence of any demonstrable lesion. Further investigations confirmed the findings noted previously, except that repeated blood-counts now

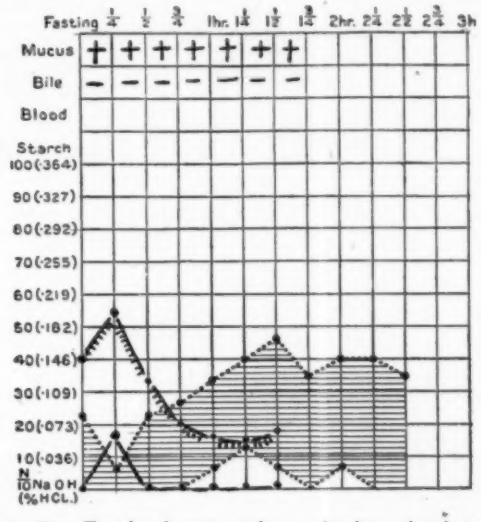

FIG. 365.—Fractional test-meal examination, showing low acid secretion.

showed the number of white cells to be 5–10,000, with an eosinophilia of between 5 and 10 per cent. (Totals—250 to 1000 per c.mm.) Bleeding time (Dukes) 1¾ min. (normal 1–5 min.). Clotting time (Lee and White) 4 min. (normal 3–10 min.). Repeated stool examinations over a period of several weeks failed to show the presence of any ova or parasites. Sigmoidoscopy to 30 cm. showed the colon to be quite normal.

There was no evidence of allergy either in the patient's history or in that of any member of his family.

OPERATIVE FINDINGS.—Laparotomy was carried out on Sept. 22, 1949, through an upper right paramedian incision, and the peritoneal cavity found to contain a little clear serous fluid. The striking feature of the abdominal exploration was the condition of the pyloric portion of the stomach, which presented a most unusual appearance.

There was marked redness of the peritoneum and œdema of the whole thickness of the pyloric antrum, and from this situation œdema spread into the lesser omentum and the upper part of the gastrocolic omentum. Scattered over the pyloric antrum there were a few small yellow nodules, situated just below the serous coat, the nature of which it was not possible to ascertain. The œdema made the entire pyloric end of the stomach feel thickened and firm, but its consistency was not that of a typical pyloric neoplasm. The remainder of the stomach both looked and felt quite normal in texture. Three enlarged

but discrete and firm glands were present in the subpyloric region. The general impression gained from these findings was that the lesion was similar to that found in regional ileitis.

Extensive exploration of the abdomen failed to show any other lesion; the liver and the spleen were quite normal.

In view of the indeterminate nature of the lesion, which appeared so remarkably localized in the pyloric antrum, gastrectomy was decided upon. A subtotal gastrectomy was performed, with removal of a portion of the first part of the duodenum. An afferent-loop-to-lesser-curve anastomosis was made in front of the colon. During suture of the anastomosis it was noted that the gastric mucosa was mammillated and very vascular.

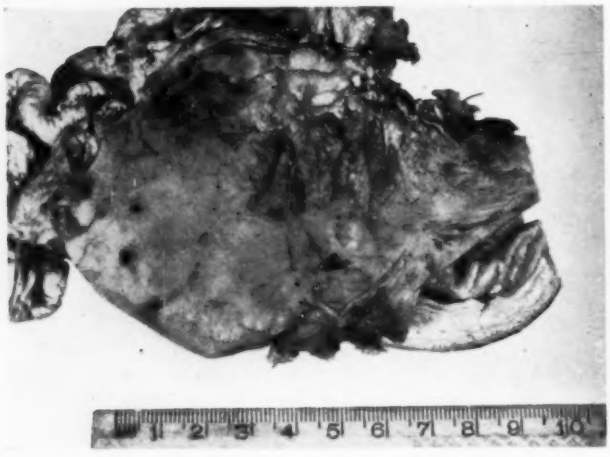

FIG. 366.—Posterior aspect of the stomach. The lesser curvature is above and shows a subserosal wrinkling and nodularity extending one-third of the way towards the greater curvature.

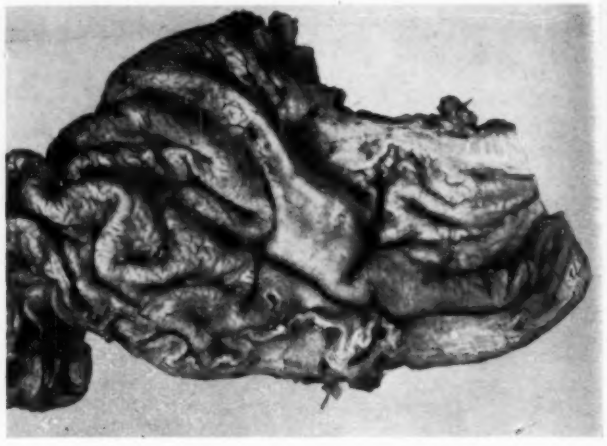

FIG. 367.—Internal aspect of the anterior half of stomach. The gross thickening of the wall of the pyloric antrum is seen on section, ending fairly sharply above at the junction with the fundus. The mucosa shows both œdematous and mammillated areas.

FIG. 368.—Photomicrograph of the wall of the pyloric antrum, showing massive œdema of the submucosa and disorganization of the muscularis. (H. and E.) (× 7.)

POST-OPERATIVE PROGRESS.—On the fourth day after operation the patient had a slight hæmatemesis which rapidly cleared up, and subsequently he made a rapid and complete recovery. It was thought that this delayed hæmorrhage may have been due to early absorption of catgut, as on this occasion size 00 was used, instead of the usual size 0 gut.

There has been no recurrence of dyspepsia or of hæmatemesis or melæna during the eight months following operation.

Blood-counts were taken on three occasions since operation and these have all been quite normal.

PATHOLOGY.—

Macroscopical.—Fixed specimen of distal two-thirds of stomach with a ½-cm. cuff of duodenum, 13 cm. along greater curvature and 9 cm. along lesser curve. External surface showed injected serosal vessels over distal one-third of stomach. The distal three-quarters of lesser curvature showed a peculiar, fine, tuberose, yellow nodularity which distorted the serosa and extended for a distance of 2 cm. on the anterior surface and 3 cm. on the posterior surface towards the greater curvature (*Fig.* 366).

The mucosa showed both œdematous and mammillated areas, but no ulceration and no erosions (*Fig.* 367). Cross-section of the greater curvature showed the pyloric antral wall to be thickened up to 1 cm.; proximal to the antrum the thickening ceased rather abruptly and the wall became normal in appearance (*Fig.* 367). Distally the thickening ceased abruptly at the pyloro-duodenal junction. There were moderately enlarged lymph-nodes along both curvatures.

Microscopical.—Pyloric antral sections show an overall picture of an intense acute inflammation affecting the submucosa, muscularis, and subserosa. Inflammatory œdema affecting chiefly the submucosa accounts for most of the increased thickness of the stomach wall (*Fig.* 368). The *mucosa* is infiltrated with a moderate number of neutrophil and eosinophil polymorphonuclears, but otherwise appears normal. The fibres of the *muscularis mucosæ* are separated and the *submucosa* is widened to about 0·5 cm. by œdema fluid which is rich in both coagulated albumin and fibrin threads. There are present enormous numbers of both discrete and massed eosinophils in addition to a fair number of macrophages and occasional neutrophil polymorphonuclears. Distended lymphatic vessels are prominent, many of them stuffed with eosinophils, lymphocytes, and macrophages. Part of the exudate and walls of some of the most affected lymphatics show commencing necrosis. The capillaries and venules are dilated and contain numerous eosinophils in their lumens. All layers of the *muscularis* show a separation of their fibres by an inflammatory œdema (*Fig.* 369), and in addition a widespread and advanced necrosis of muscle-fibres, many of which are heavily

infiltrated with eosinophils (*Fig.* 370). The *subserosa* shows a similar intense acute inflammation, with large focal collections of massed eosinophils (*Fig.* 371). The latter form the nodules seen macroscopically.

Sections of the *fundus* show a few scattered eosinophils in the submucosa and deeper coats, but apart from this all coats appear normal.

Lesser Omentum: There is a patchy acute eosinophilic infiltration of the paragastric adipose tissue, and one of the two lymph-nodes sectioned show sinusoids rich in eosinophils.

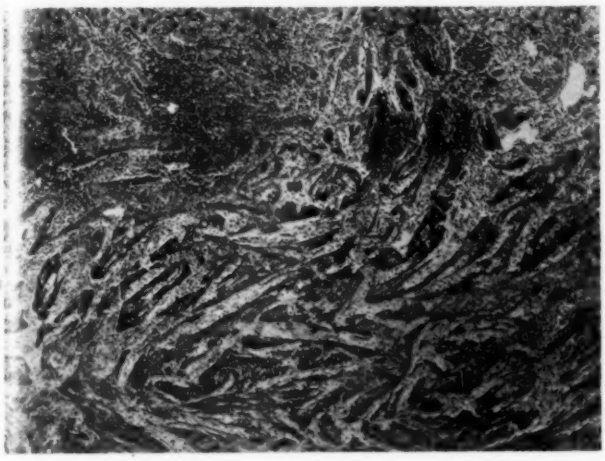

FIG. 369.—Muscularis of wall of pyloric antrum, showing disorganization and thinning of muscle-fibres, interstitial œdema, and focal cellular infiltrations. (H. and E.) (× 19·5.)

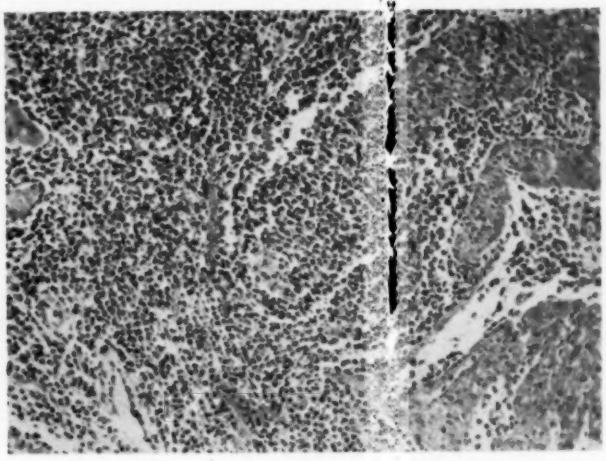

FIG. 370.—Muscularis of wall of pyloric antrum, showing massive infiltration with eosinophils of both the interstitial tissue and the muscle-fibres. (H. and E.) (× 95.)

Careful examination of the *arteries* of all coats of the stomach and in the lesser omentum show only one focus of fibrinoid necrosis, affecting an arteriole transversing a subserosal focus of massed eosinophils. One section taken specially to include numerous gastric vessels cut longitudinally reveals no arteritis. Scattered vessels, veins, and arteries in all coats show cuffing with eosinophils. No parasites are seen in any of the sections.

Comment.—In the absence of mucosal erosion or of any other obvious source of bleeding elsewhere in the intestinal tract, the recurrence of the gastrostaxis must be considered to have arisen from capillaries in the congested mucosa of the acutely inflamed pyloric antrum. The hæmatemesis in November, 1948, probably represents a similar severe attack of acute gastritis. The 2½ years' dyspepsia is unlikely to be based upon a severe chronic inflammation affecting all coats of the stomach since sections show no gross scarring. Nor was the gastric inflammation during the previous hæmatemesis likely to have been so severe as the present one since the muscularis shows fresh necrosis only. The chronic dyspepsia therefore is considered to be based upon a mild reversible antral mucosal inflammation, probably associated with submucosal œdema and possibly with pylorospasm.

DISCUSSION

Three similar cases reported in the literature are as follows :—

Case 1. Schneider and Dailey (1948): A 64-year-old man was admitted with three weeks' intermittent melæna. He had had a brisk hæmatemesis one year previously and dull epigastric pain unrelated to eating for one year.

Investigations: Hb 48 per cent, eosinophils 1 per cent total white-cell count 9400 per c.mm.), barium meal shows pronounced deformity and constriction of the lower third of stomach without ulceration, and 50 per cent retention at six hours. At laparotomy the whole antral wall was found to be thickened and pliable; a biopsy showed striking œdema of the submucosa with a cellular exudate rich in eosinophils, cellular invasion of the adventitia of arteries and veins, and a suggestion of fibrinoid necrosis of some of the arteries. There were heavy collections of cellular exudate between fibres of the muscularis. No allergic history could be obtained. The case was considered to be one of visceral angiitis of the stomach, possibly part of a systemic disease. Gastroscopy two months later disclosed a cobblestone appearance of the mucosa of the distal third of the stomach, non-enlarged rugæ, and moderate antral narrowing.

Case 2. Barrie and Anderson (1948): A 27-year-old woman was admitted with two weeks' constant circumumbilical pain and vomiting after meals. She had had a similar attack four years previously associated with melæna. Barium meal showed a smooth filling defect involving the greater curvature of the prepylorus and a small gastric residue after 6 hours. Hb 120 per cent, eosinophils 18 per cent (3060 per c.mm.). Laparotomy showed a thickened indurated friable pylorus, duodenum, and first 2 ft. of jejunum. Partial gastrectomy was performed, followed by anterior gastrojejunostomy and

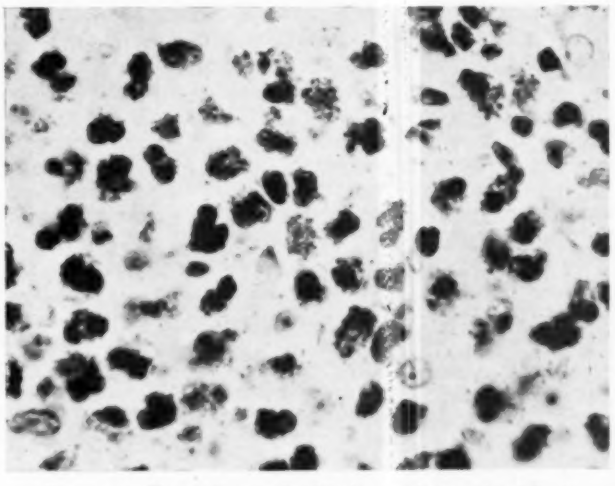

FIG. 371.—Photomicrograph showing typical eosinophils in the subserosa. (H. and C. 2 R.) (× 690.)

enteral anastomosis. Sections of the wall of the pyloric canal and duodenum showed marked hypertrophy of the muscularis, which was massively infiltrated with eosinophils. The prepyloric submucosa was grossly œdematous; there was a mucosal erosion in the pyloric canal. Deep in the pyloric muscle were three follicles composed of giant cells and epithelioid cells arranged radially around a central zone of strongly eosinophilic necrotic material. The case was considered to be one of a true organic intestinal allergic reaction, the diagnosis being chiefly on the blood and histological findings.

Case 3. Moloney (1949): A woman aged 57 was admitted with two weeks' vomiting after meals and stabbing abdominal pain. (Three years previously she had had an attack of abdominal pain lasting six weeks, associated with slight ascites; a differential white blood-count taken at that time showed 12 per cent (1200 per c.mm.) eosinophils.) Laparotomy showed a considerable ascites, fibrotic omentum, a thickened friable pyloric antrum and first part of duodenum, and similar changes in the fourth part of duodenum and first 60–90 cm. of small bowel. The condition resembled Crohn's disease at a very high level. Biopsy of the thickened pyloric tissue showed hypertrophy of the muscularis and a massive cellular infiltration, predominantly eosinophilic, of the interstitial perivascular connective tissue. No allergic factor could be traced.

Vaněk (1949) described 6 cases of dyspepsia found on partial gastrectomy to be due to a localized obstructive prepyloric submucosal granuloma infiltrated with a fair number of eosinophilic leucocytes. None of the patients had hæmatemesis or melæna, and of those recorded none showed a blood eosinophilia and none gave a history of allergy. The clinical and pathological findings suggest a different entity from the one we have described.

The three cases summarized above are very similar to our own, and from their combination it is possible to build a composite clinical and pathological picture, as follows: The disease can affect adults of either sex. The symptoms consist chiefly of chronic upper abdominal pain unrelated to meals, punctuated by bouts of more severe pain usually associated with melæna and hæmatemesis. Blood-count shows an eosinophilia, barium meal a narrowed pyloric antrum and a 6-hour gastric residue, gastroscopy a mammillated mucosa and antral narrowing. At laparotomy there is found a gross thickening of the pyloric antrum and sometimes of parts of the duodenum and jejunum. The pathological findings are: acute inflammation of the stomach wall with an exudate strikingly rich in eosinophils, gross œdema of the submucosa, and massive infiltration of the muscularis wit eosinophils. Arteritis is not a primary feature an a history of allergy is not obtained.

In most respects the above findings point to reaction to a sensitizing agent. Allergic affection of the alimentary tract are recognized. Barrie an Anderson (1948) quote 3 such cases described b Kaijser (1937); two affecting the small gut of syph ilitic patients who had developed a neoarsphen amine sensitivity and one affecting the stomacl of a man allergic to onions. However, we ar unable to find any such history of allergy in our ow case or the three summarized. Afendulis (1948) described 5 cases of acute allergic gastritis associated with amœbiasis of the colon, and we therefore took particular care with the clinical examination before excluding this aetiology. We have also considered gastro-intestinal manifestations of polyarteritis nodosa or of malignant hypertension, but have ruled them out in the absence of typical histological lesions and general manifestations. Finally, in view of the histological picture, we considered the possibility of an unusual cellular reaction to a pyogenic infection of the stomach wall, which cannot be disproven but is rendered unlikely in the absence of fever. To sum up, we feel that we can neither prove nor disprove allergy and must leave the aetiology open.

SUMMARY

The clinical and pathological findings are described in a case of dyspepsia and hæmatemesis due to eosinophilic gastritis and the literature is briefly reviewed. Reference is made to similar cases recorded in the literature.

We are indebted to Mr. J. G. Griffin, A.I.M.L.T., and Mr. L. E. Wright, A.I.M.L.T., for the histological sections, and to Mr. K. G. Moreman, A.R.P.S., A.I.B.P., for the photographs and photomicrographs.

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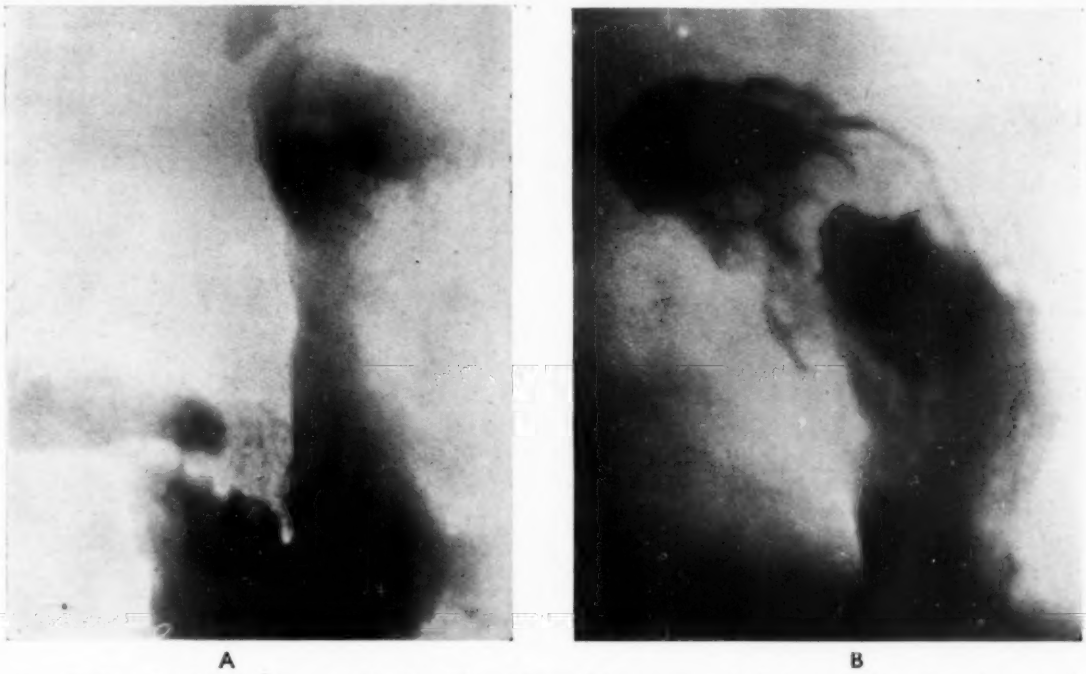
GASTRIC NEURILEMMOMA

By JOHN A. BATY, Shrewsbury

Gastric tumours of neurogenic origin have recently received increased attention in the literature, but the few cases which have been reported in detail appear to justify the recording of a further example. The location of the tumour will naturally influence the clinical picture, but, irrespective of site, hæmorrhage is noted as the most common symptom (50–80 per cent) and in this respect the case to be described is not unusual. In those instances, however, where a gastric neurilemmoma ulcerates through the mucosa and has its necrotic centre open to the action of the gastric juice, it would not be surprising for the patient to have some fœtor of the breath. Although this symptom might well have been present in some of the cases previously recorded, there has been no attention drawn to it.



A B

Fig. 372.—Radiograph of the barium meal, showing filling defect and large crater. A, Patient standing; B, Patient recumbent.

CASE REPORT

History.—Mrs. Mary A, aged 63, had had a flatulent type of dyspepsia for more than five years. Her upper abdominal discomfort would come on soon after a meal and relief followed if wind were brought up. In April, 1947, without any warning, she developed acute epigastric pain which was followed by a severe hæmatemesis and collapse. Because of this, she was admitted to a cottage hospital and was told that the bleeding had come from a gastric ulcer. There was no radiological investigation, her diet was gradually increased, and after six weeks she returned home on an ulcer diet combined with an alkaline mixture. In spite of careful diet, the flatulence continued but the medicine seemed to give some relief. In the summer of 1949 the patient gradually became conscious of a constant ache under the left costal margin and her discomfort was aggravated if she sneezed or coughed. About this time she noticed a disagreeable taste in the mouth, and it was not long before her relatives noted that her breath was extremely offensive. Because of the unpleasant eructations, the patient insisted that her doctor send her for an X-ray examination, and in January, 1950, she first attended the medical Outpatients at the Royal Salop Infirmary, Shrewsbury. At this time she did not admit to any diminished gastric capacity, the appetite was fair, but she had restricted her diet because of the 'ulcer'. No vomiting had occurred and the bowels were regular. The weight had been steadily decreasing. Previous health had been good; some five years ago she had been operated on for prolapse. Her only other disability had been from a varicose ulcer.

None of her numerous sons and daughters had any signs of neurofibromatosis.

On Examination.—Spare build, somewhat pale. Hb., 60 per cent; R.B.C., 3·6. Skin dry, with several pigmented moles on the face and small subcutaneous nodules on the face and back. Tongue clean and moist; edentulous. No cervical glandular enlargement. No abnormality found in the respiratory and cardiovascular systems. Abdomen: Some muscle laxity in the subumbilical region. Hernial orifices intact. Projecting below the left costal margin was a hard mass, slightly tender and moving with respiration. Peristaltic sounds normal and shifting dullness absent. Rectal and pelvic examination negative. Varicose veins both legs and a chronic varicose ulcer proximal to the right ankle. Urine: No abnormal constituents. W.R. and Kahn tests negative.

Radiological Report (Feb. 8).—"There is a large ulcer crater on the posterior wall of the stomach in the fundus region. The gastric mucosa in this region is completely distorted. Appearances suggest a malignant ulcer in the fundal region of the stomach." (*Fig.* 372.)

At Operation (Feb. 23).—Anæsthesia: Pentothal, curare, and oxygen (Dr. McGwinn). The abdomen was first opened through an incision extending from above the umbilicus to the 9th costal cartilage and dividing the left rectus muscle. A large mass was found in the fundal

region of the stomach with spleen and pancreas adherent; there was no fixity to the diaphragm, no free fluid, no palpable glands, and no liver involvement; the pelvis was clear. The incision was therefore extended over the chest and the whole of the 9th rib resected. The diaphragm was divided down to the œsophageal margin and its cut edges anchored to the external oblique. A good exposure was obtained and after division of the posterior limb of the lienorenal ligament, the spleen, stomach, and pancreas were mobilized medially. The left gastric

portable X-ray examination of the chest (Feb. 24) showe collapse of the left lung, with effusion and broncho pneumonia on the right side (*Fig.* 373).

On Feb. 25 some 335 c.c. of blood-stained fluid wa aspirated, after which procedure respiratory difficult rapidly lessened and the patient from then onward steadily improved. With the onset of the chest symp toms the drip had been discontinued and 4-hourly recta salines substituted. From the second post-operative da the patient was allowed sips of warm water, and on th

FIG. 373.—Radiograph of the chest, showing post-operative collapse of the left lung with effusion and broncho-pneumonia on the right side.

FIG. 374.—Radiograph taken four weeks after operation, showing complete re-expansion of the lung.

artery was ligated and divided near its origin and the lesser curvature cleared. After dealing with the splenic vessels, the lower end of the œsophagus was divided between clamps and the specimen, consisting of fundus and body of stomach with tumour, spleen, and tail of pancreas, was removed. The small remaining portion of the pyloric antrum was closed with a double layer of continuous catgut. Continuity was re-established by a two-layer anastomosis between the mobilized œsophagus and the anterior aspect of the pyloric antrum (inner layer, interrupted fine thread; outer layer, continuous catgut). Strain was taken from the anastomosis by anchoring the stomach to the under side of the diaphragm. The diaphragm was then repaired with thread sutures and the chest and abdomen closed without drainage after insufflation with penicillin-sulphathiazole powder. As the pleura was closed, inflation of the lung was not pressed as the pharyngeal pack had become soaked and foul smelling. During the operation, which lasted 3¼ hours, the patient had 3 pints of blood and this was followed by an intravenous drip of normal saline. At the time of leaving the table, the pulse was 110 and of good volume.

PROGRESS.—Post-operatively, 100,000 units of penicillin was given and 50,000 units continued 3-hourly for eleven days. In addition, soluble sulphamerazine 0·5 g. was maintained 4-hourly for five days.

The day after operation was disturbed by election results and when the patient's party gained a victory, she cheered and waved her arms along with the drip, which continued to run. Next day she was at her lowest; she had considerable respiratory distress and presented a pinched, cyanosed appearance unrelieved by oxygen. A third day she had orange juice, tea, and milk. Flatus was passed on the third evening and thereafter the diet was gradually increased, the first solids being taken on the twelfth day. The wound healed by first intention and all sutures were removed on the twelfth day, when the patient was allowed out of bed. The temperature had remained subnormal whilst she was critically ill with the chest complication, and thereafter an elevation to 99 was recorded on three occasions.

Re-expansion of the left lung was complete in four weeks (*Fig.* 374).

The patient reported in the out-patient department two months after operation; weight had increased, the appetite was good, and she enjoyed small meals of all types without experiencing any dyspepsia. The foul eructations no longer troubled her or her relatives.

PATHOLOGICAL REPORT (Dr. Gregor Grant and Dr. Symons).—The specimen (*Fig.* 375) consists of a stomach, about 15 × 7 × 5 cm., already opened along the lesser curve; a large cystic mass about 12 × 8 × 5 cm. fused to its greater curvature and apparently inside the omentum; the spleen, 11 × 6 × 4·5 cm., a small spleniculus 1 cm. in diameter; 5 cm. of the tail of the pancreas up to 4 × 1 cm. in cross-section.

About 4 cm. from the cardiac end of the stomach there is a large hole in the greater curvature, about 2·5 × 2 cm. in diameter, leading into a ragged cavity. Section shows this ragged cavity, which is about 8 × 5 × 4 cm. in size, to be the necrotic centre of a large solid oval-shaped tumour. The tumour has a well-defined outer capsule except at its opening into the stomach. The spleen and pancreas both appear normal. A number of small firm lymph-nodes

were found in the omentum; three of these nodes were sectioned. Blocks taken through the hole in the stomach and underlying area in two bits.

Microscopical examination shows that the gastric mucosa is quite intact and normal in appearance. Beneath the muscularis mucosæ is the well-defined edge of a tumour composed of interlacing bands of spindle cells very beautifully showing regimentation of their nuclei (*Fig.* 376). It is moderately secondarily infected. At the point where the tumour can be seen to have burst through

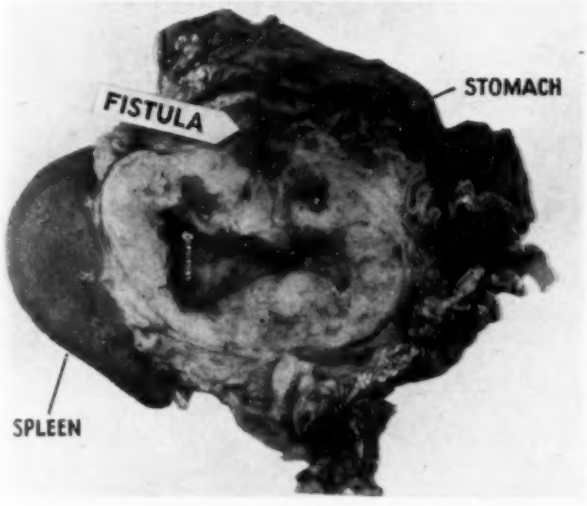


FIG. 375.—Photograph of the anterior half of the specimen viewed from the posterior aspect, showing the encapsulated neurilemmoma and its central cavity communicating with the stomach. (× ½.)

the muscularis mucosæ and the gastric mucosa, it does not give the impression of malignant infiltration so much as pressure atrophy (*Fig.* 377).

This is a neurilemmoma (Schwannoma), which, though cellular, does not appear frankly malignant. All of the three lymph-nodes examined show well-marked reactive hyperplasia but no sign of metastatic deposits.

DISCUSSION

A recent review by Canney (1948) leaves little to add to the subject of neurogenic tumours of the stomach, but, even so, the example described presents a few additional points of interest. The extensive breakdown in the centre of the tumour and the opening up of a fistulous tract through the gastric mucosa, produced the symptom which led the patient to insist on a radiological examination. French (1930) lists many possible causes for foul breath without inclusion of any example such as this.

The radiographs are particularly interesting and had a gastroscopy been carried out it should have been possible to decide that the growth was not a gastric carcinoma. Although the diagnosis of simple growth was not made until after removal, the presence of pigmented moles, the absence of cachexia, the hæmatemesis, and the duration of the symptoms, might have led one to suspect that the mass was a neurogenic tumour.

Even had the correct pre-operative diagnosis been made, it would not have been possible or advisable to attempt enucleation or local removal. By using a thoraco-abdominal approach, the resection was considerably facilitated. Although bronchopneumonia is regarded as the post-operative complication which is usually fatal and the first radiograph of the chest would appear to confirm that this actually did develop, fortunately in this instance the rule was not followed and recovery was complete.

FIG. 376.—Photomicrograph of the tumour, showing the interlacing bands of spindle cells and the regimentation of their nuclei. (× 80.)

I would acknowledge my thanks to Dr. Gregor Grant and Dr. Symons for the pathological details of the case reported; also to Mr. R. T. Ross for his excellent photographs.

FIG. 377.—Photomicrograph taken at the point where the tumour has ulcerated through the muscularis mucosæ and the gastric mucosa. (× 40.)

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CYST FORMATION IN RELATION TO THE STOMACH AND ŒSOPHAGUS

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THE formation of solitary cysts presenting histological features of the gastric wall and associated with the mediastinal œsophagus and stomach is a relatively rare condition. The first gastric cyst was reported in 1909 by Staehelin and Burckhardt, and up to 1940 only 11 such cases had been described, but since that time, probably owing to the greater frequency of exploratory thoracotomy, 15 more cases have been recorded.

FIG. 378.—Radiograph showing gastric cyst.

In 1947 Edgar W. Davis and David Salkin reviewed the 26 cases reported in the literature. Of these, 22 were under 4 years of age and the remainder were aged 10, 14, 15, and 23 years respectively; males predominated, 16 were boys and 10 girls.

The lesions occurred at various levels in the posterior mediastinum and expanded paravertebrally into either hemithorax, the cysts being bound by dense adhesions to neighbouring structures. Of these cysts 18 were situated on the right of the œsophagus, 5 on the left, and in 3 instances they were central in position. The cysts varied from 3 to 15 cm. in diameter, with walls from 1 to 5 mm. in thickness. In every case the cyst wall showed the regular mural structure of the stomach, but in no instance was the cyst directly connected with the stomach.

In 7 cases there was peptic ulceration present in the cyst wall and in 4 it had penetrated a bronchus. Histological examination revealed the presence of a folded mucous membrane of a gastric type containing deep branching glands with chief and parietal cells; the submucosa showed inflammatory exudate and hæmorrhages. In some cases the œsophagus exhibited pressure necrosis. Other anomalies in these cases were abdominal enteric cysts, diverticulæ, spina bifida, hemivertebræ, and scoliosis.

In contrast to these relatively large solitary cysts the gastric wall may be the seat of a diffuse cystic hyperplasia. Such a condition has been described by Scott and Payne (1947) occurring in a man of 58 whose stomach presented widespread formation of minute cysts affecting the mucosal and submucosal planes, and extending from the pylorus to the middle of the body of the stomach. The larger cysts were about the size of peas and contained a watery mucoid fluid.

W. Carl Myers (1948), in a study of the gastric mucosa, formed the opinion that the development of cysts in connexion with the stomach occurs only in the most severely destructive types of gastritis due to gastric mucosal erosion, with the infiltration and swelling of the gland outlets, followed by retention cyst formation.

It is evident from a review of the literature that cysts arising in the stomach wall or associated œsophagus fall into two distinct groups. In the first place we have solitary cysts of moderate dimension found in relation to the mediastinal œsophagus and exhibiting histological features of the stomach wall, of which there are 26 cases recorded in the literature up to 1947—none were directly connected with the stomach; in the second place the occurrence of diffuse cystic formation arising in the gastric mucosa and submucosa and associated in a few rare cases with gastritis.

In the case discussed here we have the unique occurrence of a large unilocular cyst intimately related to the entire fundus of the stomach and the cardiac end of the œsophagus, together with the presence of gastritis and a penetrating peptic ulcer of the lesser curvature, in a zone distinct from that portion of the stomach related to the mural cyst. Moreover, the patient is more than twice the age of the oldest case previously recorded as suffering from a gastric cyst.

The clinical history and operative findings may now be considered.

CASE REPORT

HISTORY.—A. C., a married woman, aged 67, enjoyed excellent health until November, 1949, when she developed symptoms of dyspepsia attributed to overwork. She complained of constant epigastric pain which radiated from time to time to the interscapular region and occasionally across the lower abdomen. The pain was minimal in the morning, becoming more severe after food, and reached its maximum intensity towards the evening. She obtained some relief from alkalis and

bismuth. The pain was never completely absent, although its intensity varied as stated. Occasionally she vomited a watery fluid, but never food or blood; vomiting relieved the pain. There was complete anorexia and progressive loss of weight—1 st. between November, 1949, and Feb. 18, 1950. The bowels were constipated apart from an attack of diarrhœa in September, 1949. On Feb. 6, 1950, a barium-meal examination showed the presence of a penetrating ulcer in the middle third of the body of the stomach on the lesser curvature. There was in addition a most unusual oval shadow which appeared below the left diaphragm and covered the whole of the fundus of the stomach. (*Fig.* 378.)

In the mediastinal variety of gastric cysts the clinical picture is one in which pressure symptoms on the œsophagus or the respiratory system result in dysphagia and regurgitation of food or dyspnœa, cyanosis, and cough, and both hæmoptysis and hæmatemesis have been reported. In the case under discussion there were no previous symptoms of dysphagia or regurgitation of food, nor any signs of respiratory embarrassment, the entire clinical picture being that of a high peptic ulcer of the stomach.

FIG. 379.—Photomicrograph showing cyst wall. (H. and E.) (× 20.)

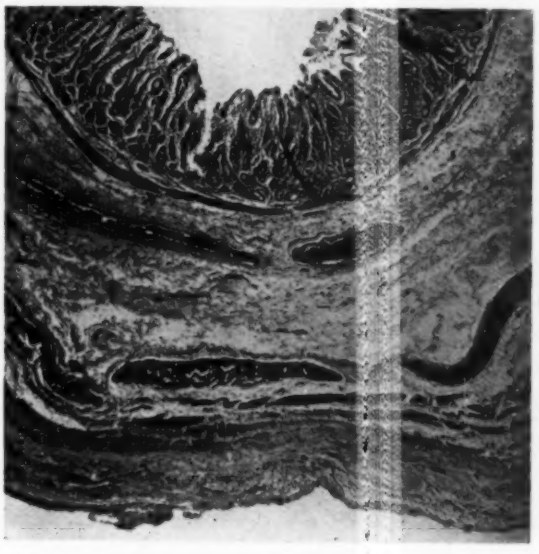

FIG. 380.—Photomicrograph showing gastric mucosa above and cyst wall below. (H. and E.) (× 32.)

ON EXAMINATION.—The patient was admitted to my surgical unit at Preston Royal Infirmary on Feb. 18, 1950. At this time she was very wasted and dehydrated in appearance. The tongue was dry and furred, the abdomen scaphoid, the skin lax and dry. Abdominal examination elicited marked tenderness over the upper left rectus, below the left costal margin, and there was pronounced muscle guarding in this area. No tumour could be palpated in the abdomen, the liver and spleen were not enlarged, and no free fluid was present; pelvic examination was negative. Fractional gastric analysis showed an achlorhydria. The C.V.S. was normal, pulse 80, volume good, blood-pressure 120/80. The chest was clear on clinical and radiological examination. Blood-urea 25 mg., hæmoglobin 90 per cent, and urine negative.

TREATMENT.—On Feb. 20 a laparotomy revealed the presence of a large tumour of spongy consistency covering the entire fundus of the stomach and overlapping the spleen and the cardiac end of the œsophagus. In addition there was a penetrating ulcer in the middle third of the lesser curvature adherent to the pancreas. A total gastrectomy and splenectomy were carried out and a jejuno-œsophageal anastomosis was followed by jejunojejunal short-circuit. During the operation some milky fluid escaped from the œsophageal end of the cyst. Post-operatively there was a period of urinary retention and mental confusion and an effusion at the base of the left pleural cavity which yielded to penicillin therapy and aspiration. After recovery from these complications she steadily improved and was discharged from hospital on March 24 and has now regained her normal weight and strength, has a good appetite, and has resumed her usual life.

PATHOLOGY.—The naked-eye appearance of the specimen excised showed a large dilated stomach measuring 25 cm. × 8 cm.; at a point about 12 cm. from the pylorus, on the lesser curvature of the stomach, there was a small ulcer penetrating the muscle coat. In the anterior wall of the fundus, near the cardiac end, and about a distance of 2–3 cm. below the lesser curvature of the stomach, there was a unilocular cystic cavity 7 cm. × 6 cm. filled with purulent exudate, a part of which had been removed. Microscopical examination of the exudate showed numerous degenerating cells, probably polymorphs, mononuclears, and red blood-cells, also numerous cholesterol crystals. Tubercle bacilli were not found in films stained by Z.N. method and cultures gave a profuse growth of contaminating organisms.

Histological examination of the specimen by Dr. A. A. Miller, of the Pathological Department, proved that the ulcer was a chronic peptic ulcer penetrating muscle. The base was composed of well-formed connective tissue in which there were foci of chronic inflammatory exudate; the appearances were quite benign.

Sections of the large unilocular cyst in the gastric wall showed that the wall of this was composed of regular layers of mucosa, submucosa, and muscularis. The mucosal lining consisted of a thick layer of pseudo-columnar epithelium; in places the epithelial cells were rounded and club-shaped; the subepithelial connective tissue was engorged and showed marked perivascular round-cell infiltration, the cells being mainly of the lymphoid type. (*Figs.* 379–382.)

DISCUSSION

It will be evident from the foregoing description that this case bears a close affinity to the solitary para-œsophageal cysts of the gastric type found at varying

levels in the posterior mediastinum, some of which have been found to exhibit peptic ulceration. On the other hand there is a linkage with cyst formation in the gastric wall associated with chronic gastritis.

Davis and Salkin (1947), discussing the origin of the intrathoracic gastric cysts, mention the work of

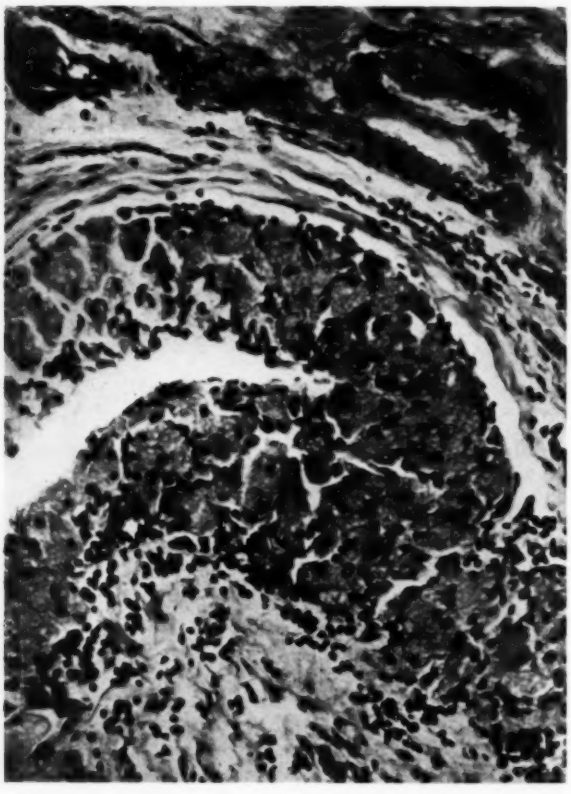

FIG. 381.—A high-power view showing epithelial lining of cyst infiltrated with round cells. (H. and E.) (× 200.)

F. T. Lewis and F. W. Thyng (1907–8) on the regular occurrence of intestinal diverticulæ in the embryos of the pig, rabbit, and man, such diverticulæ being due to the out-pocketing of epithelial nodes capable of producing gastric mucosa. On the other hand Keith (1933) advanced the view that cysts were formed by the failure of the coalescence of the vacuoles in a transverse manner when the alimentary tract is in a solid state, resulting in a cyst which may be intimately bound to the alimentary canal or become detached from it, lying in some portion of the posterior mediastinum near the œsophagus. In most of these cases of intrathoracic gastric cysts the contents are milky, brown, yellow, green, or amber coloured fluids. In some instances the material in the cyst is neutral, in others it contains pepsin and hydrochloric acid. *See also* papers by C. Boss (1937), K. Brass (1936), and M. F. Nicholls (1940).

In the case of diffuse congenital cystic hyperplasia of the stomach in a man of 58 reported by Scott and Payne (1947), the multiple pea-like cysts were lined by columnar and cuboidal epithelium and inflammatory cells were present. Furthermore, abscess formation had occurred in several of the cysts. Similarly, in the case under discussion, there was marked perivascular round-cell infiltration and the contents of the cyst contained degenerating p s cells. Taking these factors into consideratio n together with the presence of an active peptic ulc r it would seem highly probable that the solitary c t formation is primarily due to a developmental abn - mality and secondarily associated inflammato y changes. In the first case consequent upon n embryonic out-pocketing of epithelial nodes capa le of producing gastric mucosa, or, if we follow d Keith's suggestion, due to failure of coalescence of the vacuoles in the alimentary tube, there develops a partly or completely detached portion of the stoma h consisting of mucosa, submucosa, and muscle wa l. A second factor may then intervene—namely, inflam - mation—resulting in the rapid distension of the potential cyst and the onset of clinical symptoms. In the case here described it is suggested that the patient had developed a cyst during fœtal life, but the super-added factor of inflammation both in the stomach and in the cyst itself resulted in an inflammatory exudate into the potential cavity of the cyst, causing a rise of tension and the fairly rapid production of the full clinical syndrome between November, 1949, and February, 1950, in a person who had lived for 67 years without any symptoms of dyspepsia or dysphagia.

It is suggested that this case establishes a linkage between the mediastinal group of solitary gastric

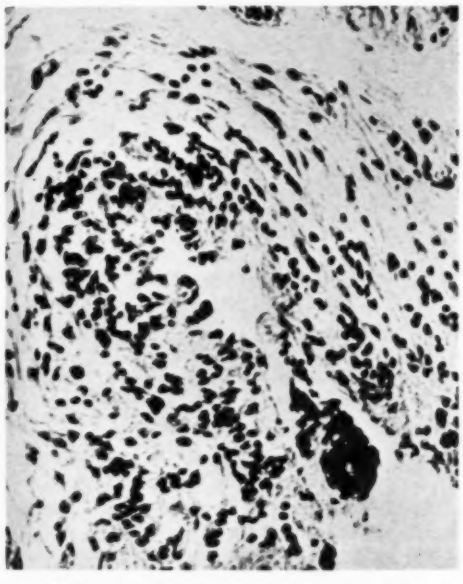

FIG. 382.—Another high-power view of cyst wall, showing degenerated mucous gland. (H. and E.) (× 280.)

cysts and those which are multiple and arise in the mucosa and submucosa of the stomach in association with gastritis. The prevalence of chronic and subacute gastritis, and the extreme rarity of the multiple cyst formation of the stomach, is a strong argument in favour of the congenital origin of all these cystic formations. In the case of the larger cysts, failure of the coalescence of the embryonic vacuoles accounts for the separate development of the gastric pocket possessing a similar histological wall to that of the stomach and one which may undergo the pathological process of peptic ulceration and may contain both hydrochloric acid and pepsin in its contents.

It has also been suggested that these cysts may arise from the vitello-intestinal duct, but the fact that at the majority exhibit the histological features of the gastric wall and œsophagus, together with the coincidence of peptic ulceration, clearly indicates their origin. Such solitary cysts may occur in relation to any portion of the course of the thoracic œsophagus, or, as in the case here discussed, in the wall of the stomach itself. On the other hand there is the extremely rare incidence of multiple cysts in the gastric wall, probably due to out-pocketing of minute epithelial nodes giving rise to a diffuse cystic formation of the mucosa and submucosa. In both these two general types of gastric cyst formation a secondary factor may occur, namely inflammation, and it is this factor that precipitates the clinical symptoms.

SUMMARY

1. The occurrence of gastric cyst formation is discussed.

2. The two principal types are described; the unilocular large cyst associated directly with the stomach or para-œsophageal zones, and, secondly, the multilocular cyst formation of minute size occurring in the gastric wall.

3. The significance of a rare case of unilocular gastric cyst formation and chronic peptic ulcer of the lesser curvature is discussed relative to these two types of cyst formation and the aetiological factors involved.

I should like to express my thanks to Dr. A. A. Miller for his report and his advice in connexion with the pathology of this case.

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RETICULOSARCOMA OF THE THYROID GLAND

BY A. DICK AND H. S. KELLETT

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RETICULOSARCOMA of the thyroid gland has been considered a rare disease in the past and its existence is not mentioned in the text-books of Ewing (1940) and Willis (1948). Five cases were reported recently by Kellett and Sutherland (1949) who found adequate descriptions of ten other cases in the literature.

Reticulosarcoma involving the thyroid concurrently with other sites, or by direct spread or metastasis from some other focus, is probably more common. Ghon and Roman (1916) described the autopsy findings in 27 cases of lymphosarcoma, and secondary thyroid involvement was discovered in three. Roulet (1930, 1932) described invasion of the thyroid gland in two cases of " retothelsarkom " out of 19; Ehrlich and Gerber (1935) in a series of 18 autopsied cases of lymphosarcomatosis found histological evidence of infiltration of the thyroid in three. A single case is also cited by Mayo and Schlinke (1941). On the other hand, clinical involvement of the thyroid is mentioned in only one case out of 102 cases of reticulum-cell sarcoma studied by Jackson and Parker (1947).

The two cases reported below are of special interest in that the thyroid tumour dominated the clinical picture. In *Case* 1 the patient died of asphyxia seven months after partial thyroidectomy, and a small intestinal metastasis was discovered at necropsy. In *Case* 2 the patient died following an operation for intestinal obstruction caused by intussusception due to a reticulosarcoma of the small intestine six months after radium treatment to the thyroid tumour; post-mortem revealed multiple other gastro-intestinal tumours. Both patients may be regarded clinically as cases of primary reticulosarcomata of the thyroid gland, although the widespread abdominal lesions in the second case are in keeping with a multi-focal autochthonous origin, possibly simultaneously in the thyroid gland and the abdominal lymph-nodes.

Macroscopically the cut surface of the tumour in both cases was of a greyish-white appearance, suggesting malignancy, but several small necrotic areas were also present. These areas resembled tuberculous foci and even histologically the necrosis and infiltration with small round cells simulated tuberculosis; specialized staining techniques were therefore necessary in the establishment of the diagnosis. It is noteworthy that these two tumours, like 14 out of 15 previously recorded cases, occurred in elderly women.

CASE REPORTS

Case 1.—J. W., a married woman aged 56, was admitted to the Southern General Hospital, Glasgow, in August, 1948, complaining of a swelling in the front of the neck of one year's duration. On examination the thyroid gland was considerably enlarged and of firm consistency; there was no evidence of hypo- or hyper-thyroidism and no recent change in weight had occurred. Partial thyroidectomy was undertaken by Mr. J. H. Levack.

Several observations on the patient's progress were made at the Out-patients' Department but in March, 1949, she was re-admitted on account of the increasing swelling in the neck, accompanied by dyspnœa, dysphagia, and aphonia. Her condition deteriorated rapidly and she died of asphyxia four days later.

AT AUTOPSY.—There was a hard swelling in the neck involving the thyroid gland and pretracheal muscles and infiltrating the wall of the larynx, trachea, and œsophagus. Several enlarged lymph-glands were present in front of the trachea below the main mass.

Case 2.—E. G., a married woman aged 66, was admitted to the Royal Infirmary, Bradford, in December, 1948, complaining of a swelling in the neck of 9 months' duration, dyspnœa, and loss of weight. A firm tumour was present in the midline of the neck, and a large

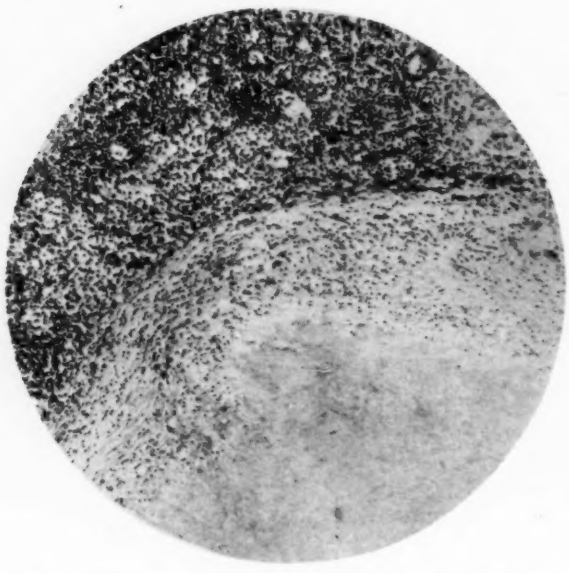

FIG. 383.—A focus of necrotic tumour tissue in the thyroid gland. (H. and E.) (× 78.)

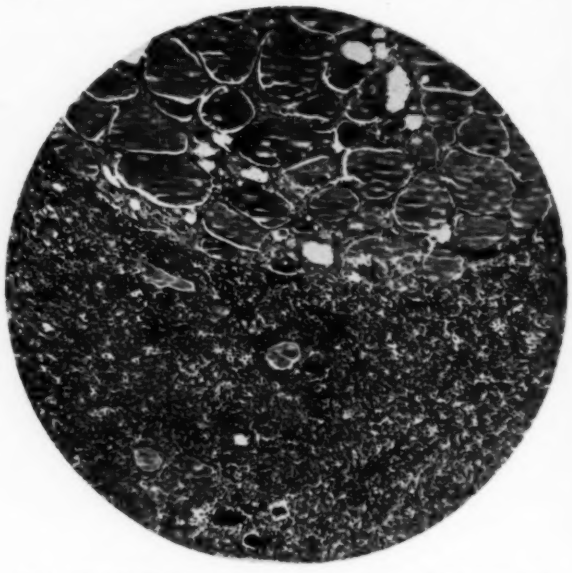

FIG. 384.—Infiltration of thyroid gland by reticulosarcoma. (H. and E.) (× 78.)

The only other abnormal finding was a tumour of the small intestine, three feet from its commencement. This tumour was 3 cm. in diameter and it extended round the wall, projecting into the lumen with resulting ulceration.

swelling in the left lobe of the thyroid. There was no evidence of hypo- or hyper-thyroidism.

On operation, Mr. F. R. R. Martin found the left lobe of the thyroid greatly enlarged and fixed, with a

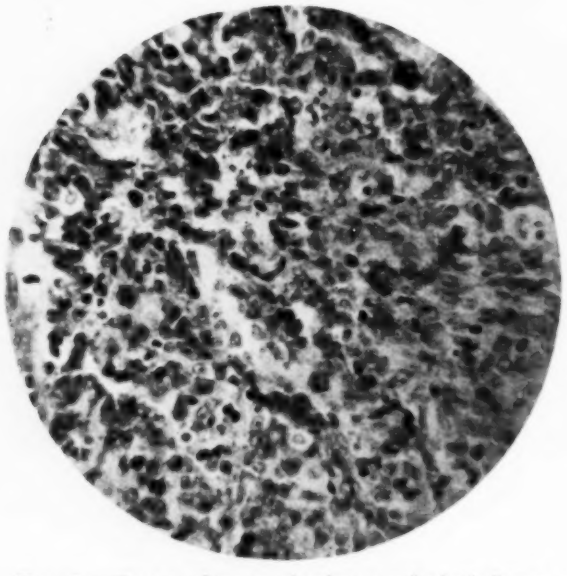

FIG. 385.—An area of tumour showing several mitotic figures. (H. and E.) (× 378.)

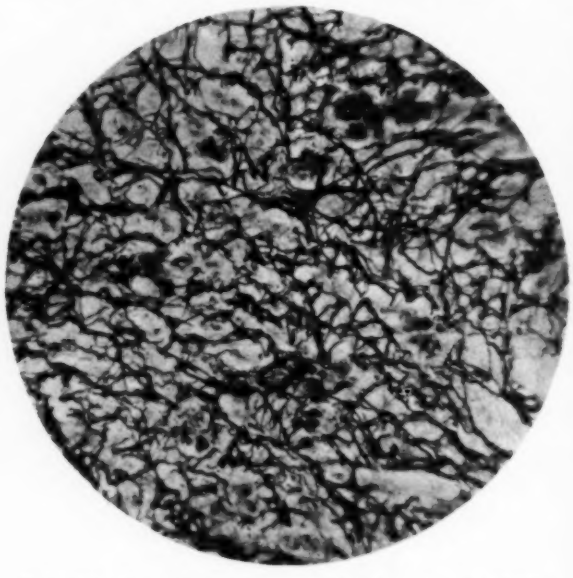

FIG. 386.—An area of tumour showing increase of reticulin. (Silver impregnation.) (× 378.)

HISTOLOGY.—Portions of the thyroid gland removed at operation and at autopsy show several foci of necrosis with surrounding fibrosis (*Fig.* 383), while the remainder of the gland is extensively infiltrated with reticulosarcoma (*Figs.* 384–386). The muscles of the neck (*Fig.* 387) and the lymph-glands also show extensive infiltration with reticulosarcoma while similar changes are present in the tumour of the ileum (*Fig.* 388).

necrotic surface. There was a solid midline swelling of 1½ in. diameter. The right lobe was relatively normal but contained a few adenomata. Outlying lymph-glands on the left side were enlarged and one of these was removed for histological examination. It was felt that mobilization of the whole gland would involve too great a surgical risk, and thyroidectomy was not performed.

The patient was then transferred to the care of Dr. E. Chester-Williams, and treated by a radium mould (500 r in 8 days). All symptoms were relieved for three months, after which the dyspnœa returned. She was re-admitted on April 30 with a firm swelling in the

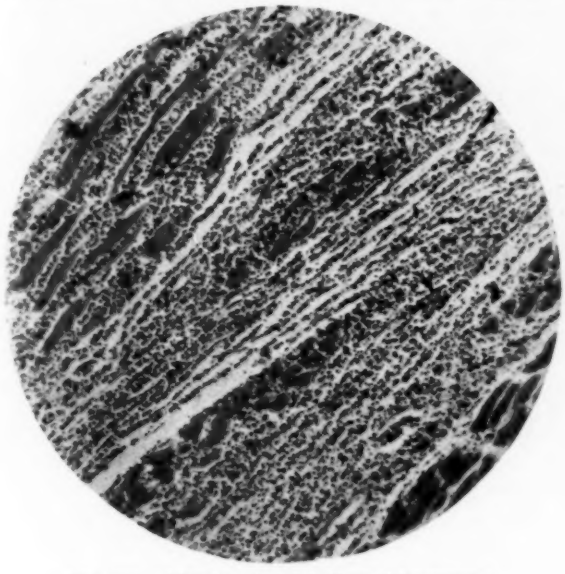

FIG. 387.—Muscles of neck infiltrated by tumour. (H. and E.) (× 78.)

midline of the thyroid region, which was again treated with radium (2500 r).

On May 30 she was re-admitted to hospital suffering from acute intestinal obstruction. Emergency operation by Mr. J. C. Angell revealed a large ileo-ileal intussusception due to a sessile tumour measuring 3 × 3 × 0·5 cm.

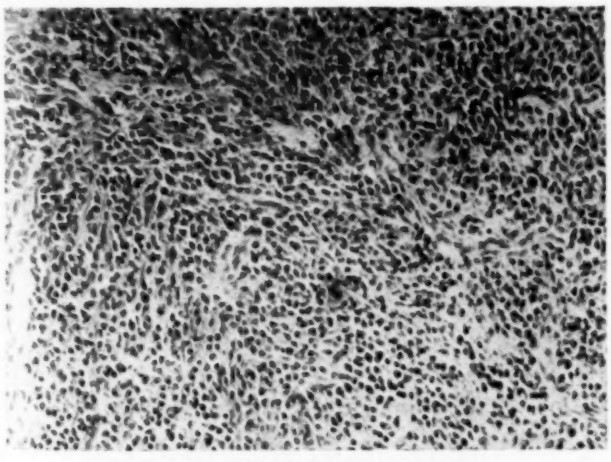

FIG. 389.—Ileum infiltrated by reticulosarcoma. (H. and E.) (× 120.)

Resection and end-to-end anastomosis was performed. The patient died a fortnight after operation from bronchopneumonia.

POST-MORTEM EXAMINATION.—*The thyroid gland* was of normal size (weight 30 g.), and adherent to the neck muscles, especially on the left side. The left lobe was fibrous and had large necrotic areas. The isthmus was of firm consistency with a greyish-white cut surface. The right lobe was fibrous and contained a calcified nodule.

Gastro-intestinal tract: The stomach exhibited a very small mucosal plaque (3 × 4 mm.) in the cardiac portion. Two plaques of growth (2·5 and 0·5 cm. in diameter) were also present in the rectum 5 in. from the anus.

Lymphatic system: A flattened, fleshy, irregular nodular tumour (measuring 4 × 4 × 2 cm. and weighing 10 g.) was found in the retrosternal region. This was not

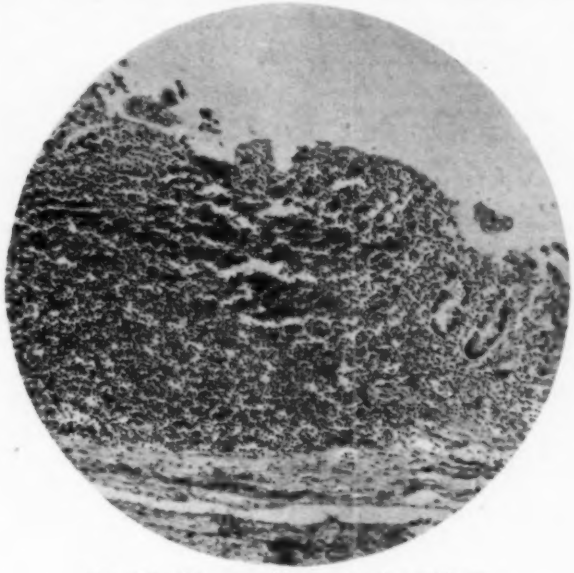

FIG. 388.—Tumour plaque on surface of ileum. (H. and E.) (× 78.)

connected to the thyroid gland and was thought to be either thymus or lymph-gland. A large retroperitoneal mass of white tumour tissue was present in the region of the cœliac axis, incompletely divided into two lateral

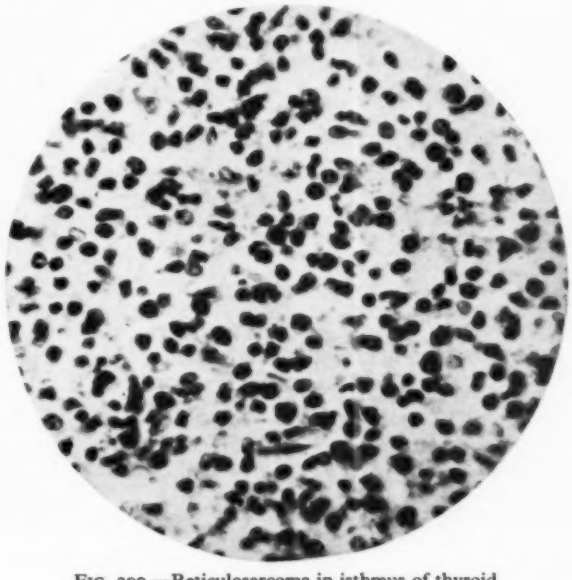

FIG. 390.—Reticulosarcoma in isthmus of thyroid. (Iron hæmatoxylin.) (× 378.)

lobes (5 × 10 × 4 cm. and 6 × 12 × 5 cm.) enclosing the suprarenal glands. The left mass infiltrated a short distance into the posterior surface of the body of the pancreas and covered half the surface of the left kidney. There were a few para-aortic lymph-nodes. The intestinal mesentery contained a few calcified glands and a few soft glands.

SUMMARY.—Reticulosarcoma of thyroid. Retroperitoneal tumour. Metastases in retrosternal gland, ileum, stomach, and rectum. Bronchopneumonia.

HISTOLOGY.—*Lymph-node* (biopsy December 17, 1948): This was a very small gland showing lymphoid hyperplasia, but in the periadenar tissue there was a cellular infiltration suggestive of reticulosarcoma.

Tumour of ileum (operation May 30, 1949): Histological section showed a reticulum-cell sarcoma, arising in the submucosa and infiltrating the muscle layers and the mucous membrane (*Fig.* 389).

POST-MORTEM (June 13, 1949).—*Thyroid gland*: The left lobe is mainly fibrous but has large necrotic zones which suggest necrotic tumour tissue. There is an occasional small islet of thyroid cells intermingled with lymphocytes and plasma cells. The *isthmus* shows areas of frank reticulosarcoma, the cells of which are rather smaller and more differentiated than in the intestinal tumours (*Fig.* 390). The *right lobe* consists of small thyroid adenomata separated by broad collagenous bands. The appearance does not suggest a neoplasm and would be in keeping with Riedel's struma. However, it is probable that previous radium therapy has modified the picture, which might have been an adenomatous goitre.

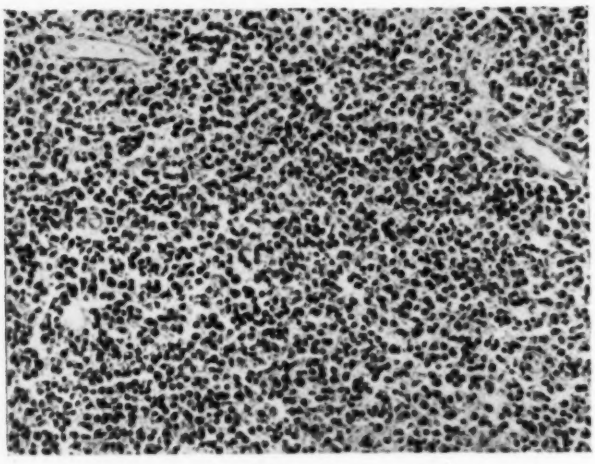

FIG. 391.—Retrosternal tumour. (H. and E.) (× 120.)

These sections suggest that the sarcoma involved the left lobe and isthmus of the thyroid and was eradicated completely from the former by the radium treatment but had recurred in the latter. The right lobe had probably not been invaded by growth.

The retrosternal tumour shows no evidence of thyroid or thymus tissue, and no recognizable lymph-gland tissue remains. The tumour consists of reticulum cells similar to the thyroid tumour, and the surrounding adipose tissue is invaded (*Figs.* 391, 392).

The abdominal tumour is composed of less differentiated reticulum-cell growth with small areas of necrosis. The tumour surrounds the suprarenal glands without destroying them, and infiltrates the posterior surface of the body of the pancreas.

The small abdominal lymph-nodes also show varying degrees of involvement.

The gastric and rectal lesions show a pleomorphic reticulosarcoma (*Fig.* 393).

SUMMARY

Two cases of reticulosarcoma of the thyroid gland occurring in elderly women are described. Intestinal involvement was present in both patients but the thyroid tumour dominated the clinical picture and death occurred some 8 months after the original operation. It is suggested that reticulosarcoma should be considered in the differential diagnosis of thyroid swellings.

We wish to thank our hospital colleagues for their co-operation and for permission to use their clinical records. We are also indebted to Mr. P. Harrison and Mr. J. McCorquodale for the photomicrographs.

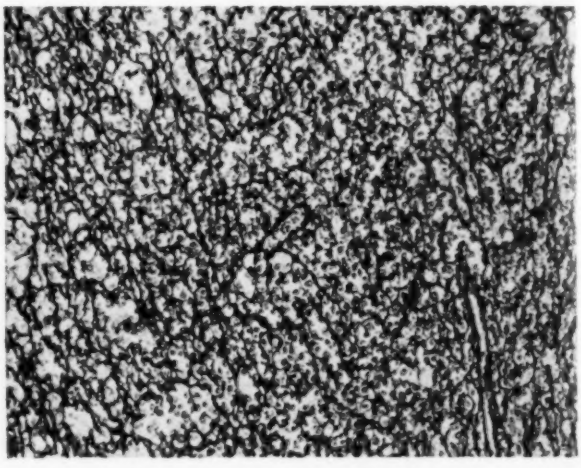

FIG. 392.—Retrosternal tumour. (Silver impregnation.) (× 120.)

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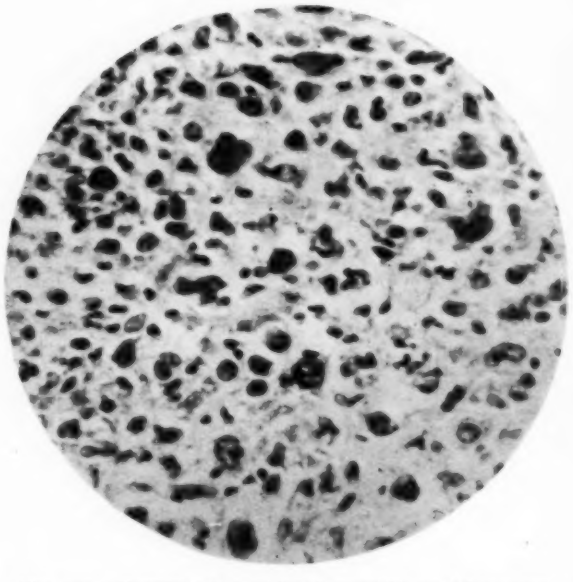

FIG. 393.—Rectum infiltrated by pleomorphic reticulosarcoma. (Iron hæmatoxylin.) (× 378.)

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A CASE OF CONGENITAL CAPILLARY HÆMANGIOMA OF THE PAROTID GLAND

By R. A. CALDWELL

FROM THE DEPARTMENT OF PATHOLOGY, STOBHILL HOSPITAL, GLASGOW

EALE (1867) described an angioma of the skin in the rotid region of a female infant aged 4 months but was not known if the gland was involved, and logg (1906) demonstrated a specimen of an angio-rcoma of the parotid to the Society for the Study of isease in Children, but no authentic case of con-enital hæmangioma of the parotid has been described in the British literature and the tumour is rarely mentioned in surgical or pathological text-books.

FIG. 394.—The child aged four months, showing the swelling in the right parotid region.

FIG. 395.—The child six months after successful removal of the tumour.

The first description was by Eröss in 1882, and in the following thirty years a number of cases were added, notably by Hardouin (1904), Herxheimer (1908), Lewitt (1908), and von Haberer (1910). In 1930 McFarland reviewed the literature, tabulating those which he considered authentic and adding a case of his own which brought the total to thirty-three. He noted that girls were affected twice as frequently as boys.

Since then a further number of cases have been described so that, although a rare tumour, it is not of exceptional rarity.

CASE REPORT

A female infant, aged 3 months, was admitted to hospital on Nov. 25, 1949, with a right-sided facial swelling of three weeks' duration, gradually increasing in size (*Fig.* 394). On examination, it was movable in all directions, soft, compressible, and fluctuant, but the overlying skin was not discoloured. A biopsy was performed and as a result the child was sent to a Maxillo-facial Surgical Unit. Mr. J. S. Tough has supplied the following operative details, and the clinical photographs :—

AT OPERATION.—The tumour was found to be non-encapsulated, dark in colour, with a bluish tint, and to be infiltrating between the lobes of the parotid. The facial nerve for the most part was deep to the tumour but parts of the tumour extended between the branches of the nerve. Excision appeared to be adequate, but it was difficult to be quite sure that no fragments were left behind. When I last saw the child ten months after the operation there was no evidence of recurrence and function in the facial nerve was full. (*Fig.* 395.)

HISTOLOGY.—The tumour is a lobulated, cellular, highly vascular tissue, containing parotid ducts and acini and without a definite capsule. The lobules individually are small, only a few mm. in diameter, and are separated by fibrous tissue septa of varying thicknesses. They are of three types, pure angioma, angioma with parotid tissue, and pure parotid parenchyma (*Figs.* 396, 397).

The angiomatous lobules constitute the greater part of the tumour. In some areas there are collapsed capillaries appearing as sheets of endothelial cells set in a delicate fibrous stroma, their ovoid nuclei of even size with lightly dusted chromatin and few mitotic figures. In others the capillaries are expanded, lined by a smooth endothelium and contain erythrocytes. Less frequently there are blood-vessels of a larger calibre with thin muscular walls, some containing elastic tissue, and a few lobules are largely composed of these.

The mixed lobules show, in addition to the angiomatous elements, a number of normal parotid ducts of varying size which join one with another (*Fig.* 396). The walls are indented in parts owing to external pressure, and their lumina are for the most part empty although a few contain acidophil structureless material resembling secretion. Some lobules also show gland acini, sometimes single and distorted by tumour pressure and occasionally in small clusters in relation to ducts (*Fig.* 398). The lobules consisting of pure parotid tissue are present only at the periphery.

In some places they are well delineated from the tumour with a thin intervening connective tissue, but in others the tumour is seen invading the normal tissue, always from within out (*Fig.* 396).

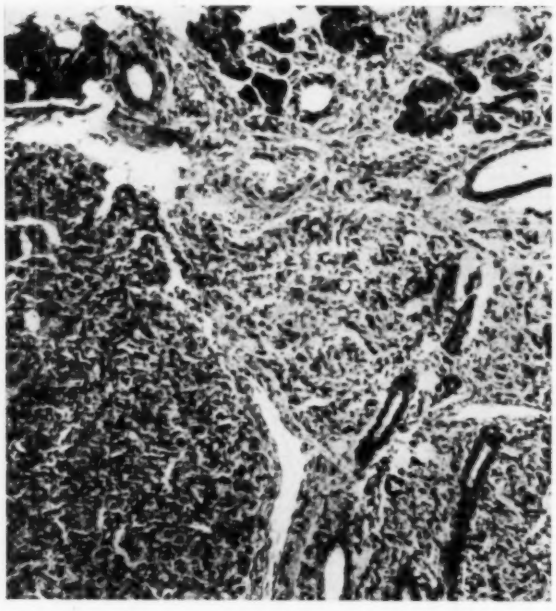


FIG. 396.—The tumour, invading parotid tissue, showing a number of medium-sized and small parotid ducts. (× 120.)

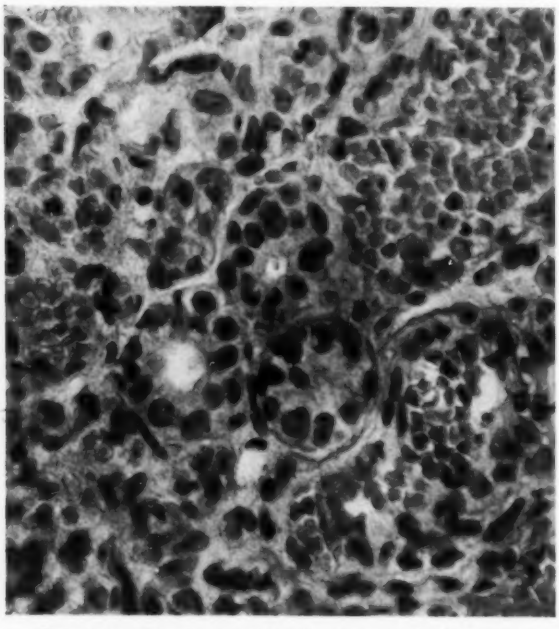


FIG. 398.—The tumour, showing two small ducts and an acinus, with collapsed capillaries and several blood-filled capillaries around. (× 480.)

DISCUSSION

Angioma of the subcutaneous tissue overlying the parotid and perhaps compressing or invading the gland has frequently been mistaken for parotid angioma, and photographs from a case are given for comparison (*Fig.* 399). A small biopsy may be misleading if either only normal tissue or pure angioma is removed. There may also be difficulty in differentiating between endothelial cells and distorted inactive acinar epithelium. Greater reliance may then have to be placed on the clinical signs.

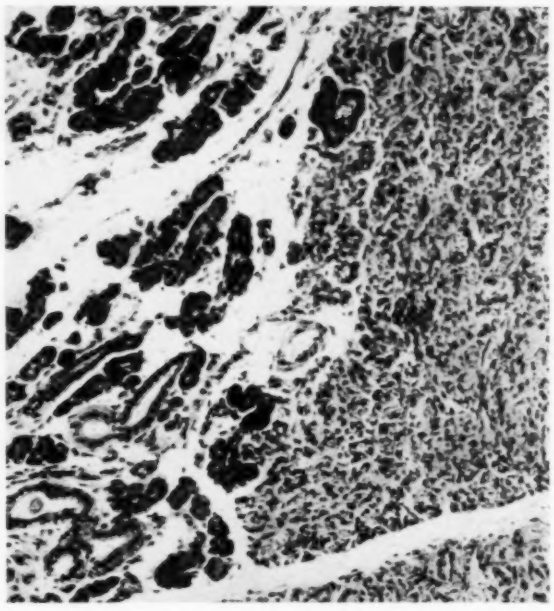


FIG. 397.—The tumour edge encroaching on parotid acini from within the gland. (× 120.)

In this case the presence of parotid ducts and occasional acini in most of the lobules and the fact that the tumour is seen to encroach on the normal gland always from within out is evidence of its origin within the gland. That the tumour can be seen invading and replacing normal gland tissue while retaining the characteristic lobular parotid structure explains why it often appears so similar macroscopically to the normal gland.

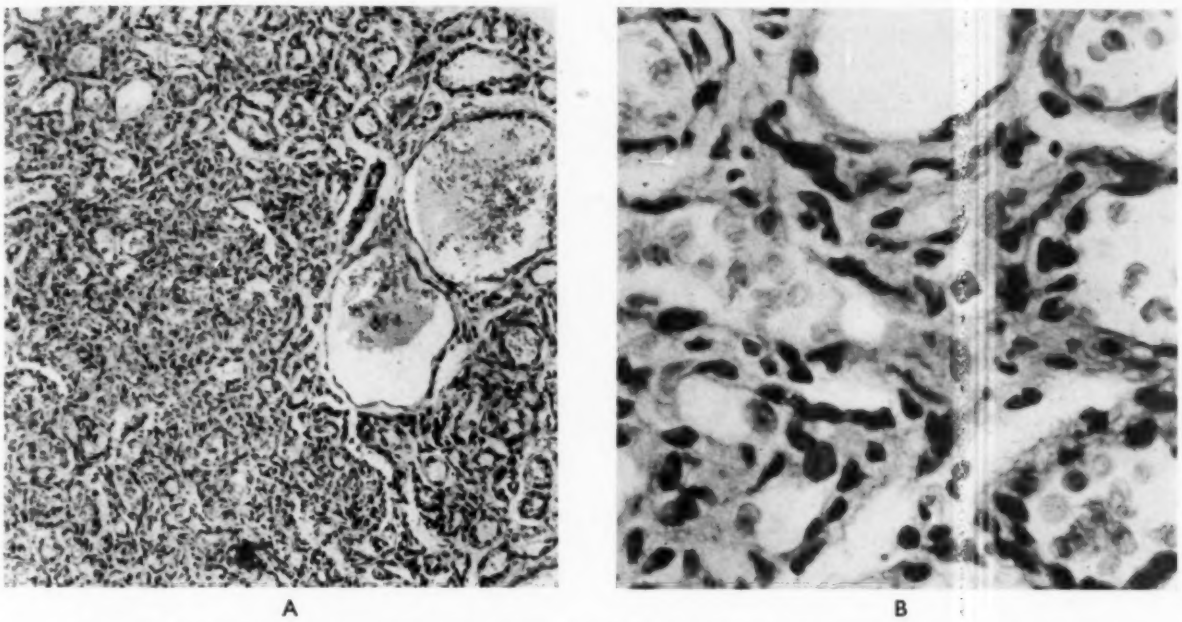
While most authors agree that the tumour is of embryonic origin, the exact site is under dispute. Herxheimer considered that it resulted from an abnormally developing stem vessel, while McFarland suggested that the vascular tissue in the embryonic gland adopts an abnormal vegetative activity, resulting in excess of capillaries which impede the proper development of the gland. In this case the gland seems to have been well developed before tumour growth commenced.

Parotid tissue apart, there is no obvious structural difference between this angioma and those which occur in the skin and subcutaneous tissues, but it is characterized by persistent, rapid, and continuous growth while those of the skin have been known to disappear spontaneously and many remain static for long periods.

McFarland suggested that the undeveloped gland unable to secrete saliva responds to secretory stimuli by distension and extension of its vessels. The presence of secretion in the ducts of this tumour and the normal appearance of the acini are against this.

Although various authors have described sarcoma-like areas in their tumours, the pale symmetrical character of the nuclei and infrequent occurrence of mitotic figures in this case, combined with the absence of secondary spread in this and any o

ıe other described cases, support von Haberer's ·ew that the tumour is pathologically benign but linically malignant. The main dangers are atrophy



A B

FIG. 399.—A subcutaneous hæmangioma from the parotid region of a child aged six months. A, × 400; B, × 500.

of the jaw, suffocation, and hæmorrhage. On the other hand, as McFarland has pointed out, there are no cases on record of recurrence after surgical removal of the entire parotid gland.

SUMMARY

A case of congenital hæmangioma of the parotid is reported. The histological appearances are described and illustrated. The possible aetiology is discussed. Complete extirpation of the tumour has given a successful result.

I wish to express my sincere thanks to: Dr. J. C. Dick (Pathologist, Glasgow Northern Hospitals) for his constant advice and encouragement; Mr. J. S. Tough, Consultant in Plastic Surgery, for the operation notes and *Figs.* 394, 395; Dr. W. B. Davis, Pathologist, Glasgow Victoria Infirmary, for the material from which *Figs.* 396, 397 were made; and Mr. W. Sillers, Southern General Hospital, Glasgow, for the biopsy.

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RESULTS OF SURGERY FOR BRONCHIECTASIS*

BY J. T. CHESTERMAN, SHEFFIELD

THE object of this paper is to assess the results of lobectomy and segmental resection of the lung for bronchiectasis with particular reference to post-operative morbidity and mortality.

The material used covers all cases operated upon during the four-year period since the setting up of a definite Thoracic Surgical Unit at the City General Hospital, Sheffield, in the summer of 1945, and thus it represents the results of team work. It consists of 114 consecutive resections for primary bronchiectasis, that is, bronchiectasis not due to tumour, lung abscess, tuberculosis, asthma, etc., and the follow-up is 100 per cent. The statistics presented are based on these cases, but in addition reference is made to failures operated upon before this period, in so far as they throw light upon points under discussion.

The first four tables give the salient features of the 114 operations upon 106 patients.

Table I. Age, Sex, and Pathology.—Age and sex require no particular comment. The division of bronchiectasis into cylindrical and saccular types is of value in that it indicates the size of the bronchus affected, the saccular forms being the more peripherally situated. Hence one type does not

* The substance of a paper read to the Association of Thoracic Surgeons of Great Britain and Ireland, Nov. 12, 1949, and brought up to date to February, 1951.

progress into the other, though cylindrical bronchiectasis may be added to the saccular type when alveolar collapse has become practically complete.

Table I.—Age, Sex, and Pathology

Age	Male	Saccular	Female	Saccular	Total	Saccular
1–10	16	5	17	2	33	7
11–20	23	6	15	2	38	8
21–30	20	12	11	6	31	18
31–40	6	3	5	2	11	5
41–50	1				1	
	66	26	48	12	114	38

Extremes of age 2½ to 47 years, both males.
Cases divided into cylindrical and saccular bronchiectasis.

The symptomatology and prognosis of the two types appear to be different.

Table II. Lobes and Segments removed.—This table confirms that saccular bronchiectasis is found far more commonly in the upper lobes and that the right side is affected more frequently than the left.

Table II.—Lobes and Segments removed

	Total	Saccular		Total	Saccular
R.U.L.	4	4	L.U.L.	5	3
R.M.L.	6	3	Lingula	1	
R.U.L. + R.M.L.	1	1	L.L.L.	51	12
R.L.L.	4		L.L.L. + L.	15	2
R.M.L. + R.L.L.	14	5	L.L.L. + L. + Segment	1	1
Segmental	6	(Pectoral, dorso-apical, basal, R.L.L. without cardiac segment)			2
R.M.L. + segment	5	5	Lingula + segment	1	

Total 114 operations.

Table III. Operative Technique.—The seven cases in brackets are classed above according to the main method used.

Table III.—Operative Technique

Two-tourniquet method	59	(operative time
Dissection	55	14 min. to 2½ hr.)
(Both methods in same case of multiple resections)	7	
	114	

Table IV. Distribution of Disease and Mortality.—Operative death has been taken to mean death any time after operation when there is an open wound present.

Table IV.—Distribution of Disease and Mortality

Diffuse (marked collapse L.L.L. in each case)	5	Deaths operative	1	Later	2
Bilateral	13	Deaths operative	1	Later	0
Unilateral	88	Deaths operative	0	Later	3
	106		2		5

Mortality (*Table V*).—There were 2 operative deaths and in each the disease involved both lungs.

There were 5 later deaths, 3 were attributable to the chest condition, one of which was an operative failure.

Morbidity.—The main problems are lack of expansion and infection on the operated side and collapse and infection of the opposite lung, but before discussion takes place, mention must be made of the pre-operative and post-operative methods used.

Pre-operative Routine.—Four points are of importance in preparation for operation, namely :—

1. Physiotherapy is used to establish normal chest wall function.

2. Reduction and sterilization of sputum. This is attempted by bronchoscopic aspiration, by aerosol intratracheal and intramuscular penicillin, or intramuscular streptomycin, and also by postural drainage.

3. The removal of iodized oil from the lungs. Pulmonary resection is not done until the lungs appear clear on screening, or show no further sign of clearing after an interval of two months. In the present series, one case of patchy lipoid pneumonia was found in the excised lobe.

4. Nasal sepsis. It is doubtful if chronic nasal sepsis can be cleared up in the presence of bronchiectasis, and treatment, therefore, is aimed at producing a clear airway, adequate drainage of the antra, and removal of the tonsils and adenoids for sepsis or obstruction.

No attempt has ever been made to produce pleural adhesions, as I have always looked upon the method as showing lack of appreciation of the aetiology of post-operative complications and of the dangers of pleurodesis.

Operative Technique.—In children the two-tourniquet method can usually be done in half an hour, and it does not leave a long bronchial stump. Sometimes, if large masses of glands are present in resection of a lower lobe, the vein is tied and divided first, otherwise the procedure is as follows: Two Roberts Nelson tourniquets, loaded with No. 18 size Chinese silk, are applied one after the other so that their cords lie one slightly above the other. The lobe is then sectioned distal to them and first one tourniquet is loosened, the silk cut from it and tied as a mass ligature, after which the second tourniquet is treated in the same way. This method does not

Table V.—Mortality

	Time	Pathology	Cause of Death
Operative :—			
1. Male, 21	6 hr.	Bilateral	Anoxia
2. Male, 22	12 d.	Diffuse	Fistula, empyema, aspiration
Later :—			
1. Female, 17	17 mth.	Unilateral	Recurrent bronchiectasis, bronchopneumonia
2. Male, 31	34 mth.	Diffuse	Cerebral abscess
3. Female, 28	7 mth.	Diffuse	Multiple lung abscesses
4. Female, 13	3 yr.	Unilateral	Headache, ventriculography, cerebral hæmorrhage
5. Male, 25	6 mth.	Unilateral	'Acute abdomen'

ave a blind bronchial stump, if done properly, d the two cords tied side by side produce a tisfactory length of bronchial apposition which pears necessary for healing, and which does not

FIG. 400.—C. S., female, aged 9. Operative time 20 min. Radiographs showing result of two-tourniquet method. Full expansion found at 24 hours. Result good.

occur so well with a single mass ligature or by mass sutures applied before removing a single tourniquet. (*Fig.* 400.)

I have used both dissection and the two-tourniquet methods for ten years and *consider dissection is indicated unless speed is essential*—that is, in small children, bad risks, wet cases, and in operative or anæsthetic difficulties.

Post-operative Routine.—A single *intercostal drain is used if lung tissue has been cut across, when oozing is present, and with a depleted staff.*

The patients are allowed out of bed and breathing exercises are started within 48 hours of operation or earlier. Any difficulty in expectoration is treated by inhalations and bronchoscopy. Intramuscular penicillin is given for a week. Any but small collections of fluid are aspirated at once, particularly if these are basal and extend from the front to the back of the chest.

MORBIDITY

The problem of morbidity can be considered under four headings: (1) Failure of expansion. (2) Spread of bronchiectasis. (3) Collapse and pneumonitis of the contralateral side. (4) In relation to congenital abnormalities found at operation.

1. Failure of Expansion.—Failure of adequate expansion of the remaining lung tissue is the most common cause of post-operative morbidity. This has been studied in 109 cases, as in the 114 resections patient died shortly after operation and 4 patients were secondary lobectomies so that the position amounted to a pneumonectomy.

Table VI indicates the *expansion times* of the 109 cases and shows in this respect the relationship of dissection and tourniquet methods. Two points appear from this table: the first is the length of time taken for expansion in many cases; and the second is that the method of dealing with the hilum

Table VI.—EXPANSION RATES
(109 CASES)

TIME	AGES 1–10	11–20	21–30	31–40	47	TOTALS
1 d.	8 (1)	2 (8)	1 (1)	(2)	(1)	11 (13) 24
2 ,,	3		1 (2)			4 (2) 30
3 ,,	1					1 31
4 ,,		1 (1)				1 (1) 33
5 ,,	1		(1)			1 (1) 35
7 ,,	1	1 (1)	(1) (1)			2 (3) 40
2 wk.	3 (1)	(2)	(1)			3 (4) 47
3 ,,	3	1 (7)	(2)			4 (9) 60
4 ,,	1	2 (1)	1 (1)	1		5 (2) 67
5 ,,		(1)		(1)		(2) 69
6 ,,		1	2 (3)			3 (3) 75
2 mth.	1	1 (2)	1 (1)	(1)		3 (4) 82
3 ,,	1	(1)		1		2 (1) 85
4 ,,	1	2	1 (1)	(1)		4 (2) 91
5 ,,	1					1 92
6 ,,	1	2	2	1		6 98
7 ,,	2					2 100
8 ,,			(1)			(1) 101
9 ,,				1 (1)		1 (1) 103
12 ,,		(1)	(1)			(2) 105
Not expanded			1 (2)	(1)		1 (3) 109
	28 (2)	13 (25)	10 (19)	4 (7)	(1)	55 (54)

Tourniquet cases not marked.
Dissection cases bracketed.
Cases in bold type have good functional result but expansion is not complete.
75 per cent or more, no fluid or drainage present.

does not make any material difference to the result, though it must be seen that the indications for the two methods make the groups not strictly comparable.

Analysis of the expansion rates in the 29 cases of segmental resection (counting the lingula as a segment) does not show any alteration from the average. However, 3 cases in this group, including 1 case of bilateral disease, have never fully expanded, though their functional result is satisfactory. This is an unduly high proportion. The figures are not appreciably altered if the lingula is counted as a lobe and not as a segment. The expansion times show no alteration with the climatic conditions prevailing at the time of operation.

Table VII.—Relationship of Expansion to Drainage

	Drainage		Total Cases	No Drainage	
	No.	Per cent	Per cent	No.	Per cent
Statim	17	28	28	13	27
14 d.	10	45	41	5	36
1 mth.	10	62	55	9	54
2 mth.	5	70	68	5	64
3 mth.	2	73	75	6	76
6 mth.	6	83	88	8	92
over 6 mth.	7	95	96	2	98
Not expanded	3			1	
	60			49	

Table VII indicates the relationship of expansion to *drainage*. Here again the table does not show any marked difference, but the indications for drainage, as already mentioned, make the groups not strictly comparable.

However, *Tables VI* and *VII* do show that, with the accepted indications, neither the method of dealing with the hilum nor the question of drainage makes any difference to the rate of expansion.

Table VIII shows the effect of *fistula formation* on the expansion of the remaining lung. The diagnosis of fistula is not always clear, but the earliest, and sometimes the only, indication is the expectoration of small amounts of serosanguineous fluid. There were 9 cases of definite fistula in the present series.

Two interesting features are suggested by this table. First the method of dealing with the hilum, provided the correct indications are accepted, does not predispose to fistula; secondly, the fistula is not now so dangerous as it was once considered, since therapeutic agents can control infection and early drainage prevent empyema formation. The real menace of a fistula is the possibility of aspiration of fluid or the spread of infection into the lung. Provided that the spread of infection is prevented, the lung can expand by surface tension and cohesion, in the same way that an intrapulmonary cavity can be obliterated by these forces, whether the bronchus is open or blocked.

Table IX shows the relationship of an *empyema* to expansion of the lung. There were 11 cases of empyema unassociated with fistula and 7 cases with fistula (*see Table VIII*), making 18 in all.

This table suggests that the tourniquet method in adults is associated with more empyemata than the dissection method, as might have been expected. Also that the expansion is slower, being on an average four months, by which time 84 per cent of all cases are fully expanded. The end-result, however, is not unsatisfactory in cases with empyema: 1 case (H. G.) has returned to professional singing, relieved of his cough, and another (G. W.) ran the 100 yd. in 11 sec.

Table VIII.—Effects of Fistula on Expansion of the Lung

Name	Sex	Age	Pathology	Lobes removed and Method	Presence of Empyema	Treatment	Expansion
1. J. M.	N.	22	Diffuse	L.L.L. 2-T	Yes	Open drainage	Death
2. D. S.	M.	28	Diffuse	L.L.L. 2-T	Yes	Open drainage	2 mth.
3. L. S.	F.	27	Diffuse	L.L.L. D	Yes	Open drainage	2 mth.
4. J. W.	F.	17	Bilateral	L.L.L. now segmental R.L.L.D.	No	Closed intercostal	2 wk.
5. S. E.	M.	27	Unilateral	R.L.L. D	No	Postural drainage	1 wk.
6. R. E.	M.	23	Unilateral	R.M.L. D	Yes	Open drainage	8 mth.
7. F. C.	M.	40	Unilateral	L.L.L. + L. D	Yes	Open drainage	35 per cent expansion in 5 mth.; healed working 24 mth.
8. J. S.	M.	25	Unilateral	R.M. + R.L.L. 2-T	Yes	Open drainage, thoracoplasty at base, still small cavity 4 yr.	
9. C. S.	M.	22	Unilateral	L.L.L. 2-T	Yes	Open drainage, closure and lingulectomy 2 yr. later.	

Table IX.—Relation of Empyema to Expansion of the Lung

Name	Sex	Age	Pathology	Lobes removed and Method	Treatment	Expansion
1. H. G.	M.	21	Unilateral	L.L.L. 2-T	Open drainage	7 wk.
2. M. S.	F.	17	Unilateral	L.L.L. 2-T	Open drainage	5 mth.
3. H. R.	M.	27	Unilateral	R.M. and R.L.L. 2-T	Open drainage	2 mth.
4. E. F.	M.	30	Unilateral	L.L.L. 2-T	Open drainage	6 wk.
5. K. F.	M.	4	Unilateral	R.M. and R.L.L. 2-T	Open drainage	7 mth.
6. G. W.	M.	18	Unilateral	R.M. and R.L.L. D	Open drainage	3 mth.
7. E. S.	M.	38	Unilateral	R.M. and R.L.L. 2-T	Open drainage	1 mth.
8. G. G.	M.	21	Bilateral	R.M. and R.L.L. D	Open drainage	5 mth.
9. D. B.	M.	31	Unilateral	Basal segments L.L.L. D	Open drainage	5 wk.
10. K. G.	F.	23	Bilateral	L.L.L. D	Open drainage	10 mth. 50 per cent
11. M. H.	F.	9	Unilateral	L.L.L. 2-T	Aspiration repeated	2 mth.

ght months after operation and five months after osure of an empyema following right middle and ght lower lobectomy.

Table X shows the relationship of *recurrent pleural fusion* to expansion of the lung. Ten cases required ree or more aspirations for non-purulent effusions d 5 cases (No. 1, 4, 7, 8, and 10) still show some limitation of expansion of the affected side, in spite of physiotherapy. One of these cases (J. G.) developed pulmonary tuberculosis on the affected side eighteen months later, though the excised lobe and bacteriology of the effusion showed no evidence of this infection. This table suggests: First, that effusion, like empyema, is more common with tourniquet resection in adults under the accepted indications; secondly, that recurrent effusion is a major cause of delayed expansion; and thirdly, that it is a major cause of subnormal function of the lung, as judged by X-ray screening for as long as cases have been followed afterwards. Bronchospirometry has not been used. I showed in 1941 that the placing of sulphonamides in the pleural cavity led to effusion, but I know of no evidence with regard to the effects of penicillin and I habitually use it intrapleurally. Late effusions do not appear to occur *ex vacuo*, as several cases of incomplete expansion have been followed for several years in patients doing household duties or manual labour.

Surgery should not be undertaken until every effort has been made to clear up diffuse chronic tracheobronchitis. If present, it is usually exacerbated after operation and, if apparently relieved, the risk of recurrence is high (about 50 per cent).

Table X.—Relationship of Pleural Effusion to Expansion

Name	Sex	Age	Pathology	Operation	Aspiration	Expansion
1. G. C.	M.	12	Bilateral	L.L.L. + L. 2-T (R.L.L. 2-T	6 0	To clavicle 6 mth. Full 24 hr.)
2. J. W.	F.	16	Bilateral	L.L.L. D (Segmental R.L.L. D	3 Fistula	Full 2 mth. Full 3 wk.)
3. F. C.	M.	23	Diffuse	L.L.L. 2-T	4	Full 6 mth.
4. M. A.	F.	31	Unilateral	L.L.L. 2-T	3	Full 9 mth.
5. D. M.	M.	16	Unilateral	L.L.L. 2-T	5	Full 6 wk.
6. M. S.	F.	31	Unilateral	L.L.L. 2-T	5	Full 3 mth.
7. J. G.	M.	20	Unilateral	R.U.L. 2-T	5	To clavicle 6 mth.
8. M. S.	M.	8	Unilateral	L.L.L. 2-T	4	Full 7 mth.
9. G. B.	F.	27	Unilateral	L.L.L. D	3	Full 6 wk.
10. D. J.	F.	20	Bilateral	L.L.L. 2-T	4	Full 2 mth.

Table XI shows the relationship of post-operative *tracheobronchitis* to expansion. Some 18 cases showed it and required repeated bronchoscopy. The predominance of dissection cases is noticeable, suggesting that length of operative time may be a factor. Comparison with the operative times of other dissection cases, however, shows nothing significant.

Table XI.—The Relationship of Tracheobronchitis to Expansion

Name	Sex	Age	Pathology	Operation	Other Complications	Expansion
1. D. K.	F.	19	Unilateral	R.M.L. D		1 yr.
2. W. L.	M.	39	Unilateral	L.L.L. D		4 mth.
3. U. J.	F.	34	Unilateral	L.L.L. D		2 mth. hernia right lung
4. K. B.	M.	18	Bilateral	L.L.L. D (R.M.L. 2-T		2 mth. 24 hr.)
5. L. S.	F.	14	Unilateral	R.M.L. + pectoral segments R.U.L. 2-T		15 d.
6. J. G.	M.	22	Unilateral	L.L.L. + L. D		6 wk.
7. G. G.	M.	21	Bilateral	R.M. + R.L.L. D	? Rupture trachea empyema	5 mth.
8. E. McF.	F.	28	Unilateral	L.L.L. D		4 mth.
9. G. W.	M.	18	Unilateral	R.M. + R.L.L. D	Empyema	3 mth.
10. K. R.	F.	30	Diffuse	L.L.L. + L. 2-T + D		Not complete 1 yr.
11. D. B.	M.	31	Unilateral	Basal segments L.L.L. D	Empyema	5 wk.
12. F. C.	M.	40	Unilateral	L.L.L. + L. D	Fistula; empyema	35 per cent expansion (At full work 24 mth.)
13. W. W.	F.	33	Unilateral	R.M.L. + pectoral segments R.U.L. D		9 mth.
14. L. W.	M.	24	Unilateral	L.L.L. + L. D		3 mth.
15. M. J.	F.	15	Unilateral	L.L.L. + L. D	Nasal sepsis	3 wk.
16. K. G.	F.	23	Bilateral	L.L.L. D	Empyema	50 per cent expansion 10 mth.
17. A. M.	F.	14	Bilateral	L.L.L. 2-T	Nasal sepsis	3 wk.
18. G. B.	F.	27	Unilateral	L.L.L. D	Pleural effusion	6 wk.

Treatment must be early and vigorous and directed against its bacteriology and the mechanical obstruction it produces, otherwise it is a major cause of delayed expansion, as is even more in evidence in earlier cases before this series began. *Case* 7 was complicated by rupture of the trachea, presumably by the inflated cuff. Emphysema was tremendous for over a week, but gradually settled down with suction drainage in about a fortnight. No evidence of bronchial fistula was ever found and the tracheal lesion was visible on bronchoscopy.

2. Spread of Bronchiectasis.—The major cause of late post-operative morbidity is spread of bronchiectasis to new areas of the lungs. This is more usual on the operated side but it may occur on the opposite side or on both sides.

In 105 patients operated upon (the 106th was a lobectomy for a similar condition, but the primary operation was done before the present series began), bronchiectasis has recurred in 10 cases.

Table XII shows the main features of the 10 cases. Recurrent bronchiectasis in my cases has always been of a saccular variety whether the original lesion was saccular or cylindrical in type.

Bronchiectasis has developed in the following conditions in this series :—

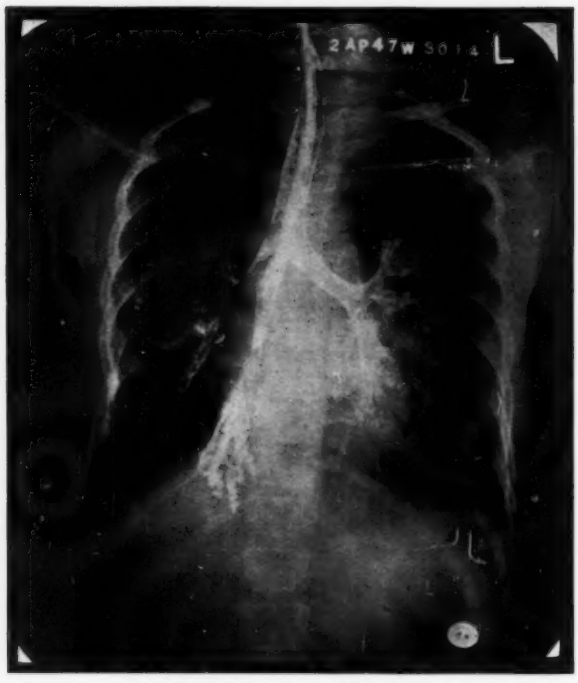

FIG. 401.—D. B., female, aged 6. Right lower lobe bronchiectasis. Bronchogram 11 months' later.

FIG. 402.—E. Y., male, aged 8. Bronchogram showing bronchiectasis of left lower lobe and lingula.

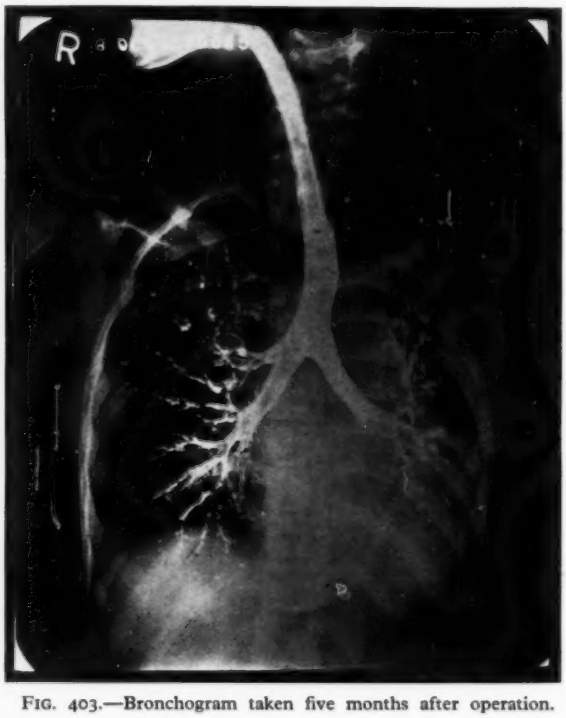

FIG. 403.—Bronchogram taken five months after operation.

FIG. 404.—Radiograph showing cysts and saccular and cylindrical bronchiectasis in collapsed right lower lobe. This bronchogram is typical of one group of the asthma of effort syndrome. (*Case* 5, *Table XIV*.)

1. Bronchopleural fistula giving rise to chronic infection of a segment of the lung, as in *Case* 1.

2. It may develop in a completely collapsed lobe, as in *Case* 2. (*Fig.* 401.)

3. It may occur in a fully expanded or partially expanded lobe. This possibility in a fully expanded lobe occurred in *Case* 4, where full expansion took place by the twenty-first day and all appeared satisfactory. Three months after resection, however, routine X-ray screening showed increasing radio-opacity of the left upper lobe and in spite of physiotherapy it became more dense and collapse started to take place and later in the fifth month bronchiectasis was found. (*Figs.* 402, 403.) This has occurred twice (*Cases* 7, 8) after pneumonia a year after lobectomy.

4. It may occur on either or both sides if the disease is bilateral. In *Case* 9 spread was suspected, but in *Case* 10 it caused surprise as the boy was much better and the radiographs showed no clouding.

The pathological process in the majority of these cases is probably one of œdema and infection in varying degrees, thus giving rise to fibrosis and bronchiectasis in the same way as it occurs in some cases of massive exudative pulmonary tuberculosis. The methods of prevention and treatment are those which combat infection and œdema.

However, it seems possible that in *Case* 10 the spread of bronchiectasis may have been due to other factors, such as neuromuscular inco-ordination and the viscosity of the sputum.

Table XII.—Recurrent Bronchiectasis

Name	Sex	Age (First operation)	Operation	Date	Recurrence	Further Operation	Date
Unilateral :—					(Same side)		
1. C. S.	M.	22	L.L.L. 2-T	June 19, 1945	Fistula empyema	Closure fistula ; lingulectomy	May 13, 1947
2. D. B.	F.	6	R.L.L. 2-T	May 13, 1946	Complete collapse R.M.L.	R.M.L. 2-T	April 21, 1947
3. S. T.	M.	23	L.L.L. 2-T	April 26, 1946	Expansion complete 4 mth., symptoms about 1 yr.	L.U.L. 2-L	Sept. 18, 1948 Died acute abdomen 6 mth. later
4. E. Y.	M	8	L.L.L. + L. 2-T+D	May 25, 1948	Full expansion 3 wk., symptoms 4 mth.	L.U.L. D	Feb. 3, 1949
5. A. B.	F.	15	L.L.L. + L. D	Nov. 30, 1948	Full expansion 1 mth., then clouding started and bronchiectasis present Feb. 7, 1949	L.U.L. D	June 2, 1949
6. M. S.	F.	17	L.L.L. 2-T	Feb. 12, 1946	Full expansion 15 wk. when bronchiectasis was obvious	Refused treatment	Died bronchopneumonia 17 mth. later
7. W. R.	M.	11	L.L.L. 2-T	Sept. 20, 1948	Full expansion 24 hr.	L.U.L. 2-T	June 1, 1950
8. H. R.	M.	29	R.M. and R.L.L. 2-T	Feb. 11, 1947	Full expansion 2 mth. empyema	R.U.L. D	June 20, 1950
Bilateral :—					(Diffuse)		
9. D. J.	F.	20	L.L.L. (also R.M.L.) 2-T	Jan. 16, 1947	Full expansion 4 mth. Symptoms recurred 1 yr. Diffuse bronchiectasis proved Nov., 1948		
10. K. S.	M.	7	R.U.L. 2-T	Jan. 8, 1949	Full expansion 6 mth. Symptoms improved. Spread found Sept., 1949, preparatory to second operation		

Damage to the artery of an adjoining segment may produce fibrosis in it, an injury to a vein will produce engorgement in its area of drainage, and it is important to avoid these mishaps when dealing with a difficult hilum.

Recurrence, if it occurs, declares itself within twenty-four months or so of the original operation.

Table XIII.—Collapse and Pneumonitis on the Contralateral Side

Name	Sex	Age	Pathology	Operation	Expansion	Area of Collapse	Times of Occurrence
1. P. K.	M.	9	Unilateral	L.L.L. 2-T	24 hr.	R.L.L.	11–24 d.
2. G. M.	M.	11	Unilateral	L.L.L. D	24 hr.	D.A. Seg. R.L.L.	10–20 d.
3. W. L.	M.	39	Unilateral	L.L.L. D	4 mth.	R.L.L.	10–20 d.
4. G. C.	M.	12	Bilateral	L.L.L. + L. 2-T	6 mth. to clavicle	Nil	
		14		R.L.L. 2-T	24 hr.	L.U.L.	3–11 d.

The 7 unilateral cases accepting further lobectomy have each made a satisfactory recovery.

3. Collapse and Pneumonitis on the Contralateral Side (*Table XIII*).—This has been insignificant. It occurred in the present series in four cases and only in *Case* 4 did it cause concern. Collapse and pneumonitis have not been separable entities.

4. Morbidity and Congenital Abnormalities found at Operation (*Table XIV*).—These abnormalities caused no post-operative complications.

FINAL RESULTS

(*Table XV*)

The table of final results needs no comment save to point out what is meant by improved cases. This is best illustrated by two radiographs *Figs.* 405, 406.

Cough.—After exclusion of bronchiectasis or a pocket of pus in the bronchial stump, it has been found that cough persists in some cases unassociated with sputum and appears to be the result of overcanalization of the reflex. In others, when sputum is present, it is due to recurrent or chronic tracheobronchitis.

Nasal Sepsis.—In all cases nasal sepsis has improved in an astonishing way.

FIG. 405.—G. C., aged 16. Radiograph three years after left lower lobectomy and excision of lingula, and two years after right lower lobectomy.

FIG. 406.—U. J., aged 36. Radiograph two and a half years after left lower lobectomy.

Table XIV.—ABNORMALITIES FOUND AT OPERATION

NAME	SEX	AGE	PATHOLOGY	OPERATION		ABNORMALITY	EXPANSION
1. V. T.	F.	17	Unilateral	R.M. + R.L.L.	2-T	Large accessory artery through diaphragm	4 d.
2. G. C.	M	20	Unilateral	L.L.L.	D	*a*. Large accessory artery through diaphragm *b*. Epiphrenic œsophageal diverticulum adherent and removed	24 hr.
3. J. W.	F.	17	Bilateral	L.L.L. Segmental R.L.L.	D D	1 yr. before Without infracardiac segment, which was separate	3 wk.
4. S. L.	F.	12	Unilateral	L.L.L. + L.	2-T	Lingula completely separate lobe	24 hr.
5. S. E.	M.	27	Unilateral	R.L.L.	D	Vein to right auricle	1 mth.

The bronchiectasis was saccular in the first two and last cases and cylindrical in the remaining cases. No evidence of sequestration of lung tissue was found in association with the aberrant arteries, and both structurally appeared to be systemic vessels.

Pregnancy.—I have the impression that there is an increased risk of acute respiratory infection in the last few weeks of pregnancy, though this is the only complication noted. Recurrent confinements, up to three, have occurred in this series without any difficulty being encountered. No complications have been noted during pregnancy and labour after pneumonectomy.

CONCLUSION

In conclusion, the following statements appear to be justified :—

1. Operative mortality now appears to be due almost entirely to avoidable errors of judgement.

2. Later mortality depends on the number of bilateral and diffuse cases operated upon, and is probably avoidable in unilateral cases.

3. Post-operative lack of expansion of the lung centres around : (*a*) Tracheobronchitis and bronchial obstruction ; (*b*) Pleural fluid whether serous or purulent ; (*c*) Bronchopleural fistula ; (*d*) Pulmonary œdema and infection.

A multiplicity of these factors usually occurs and it is frequently impossible to separate them from

ch other, though one factor usually predominates i initiating the condition. Pleural fluid and t cheobronchitis appear to be the most important.

6. Lobectomy and segmental resection offer relief in some cases of diffuse bronchiectasis, they are of increasing value in bilateral cases, and the result of operation for unilateral disease, over 90 per cent success, can hardly be excelled in any other field of surgery.

Table XV.—FINAL RESULTS

	UNILATERAL	BILATERAL	DIFFUSE	TOTALS
Operative deaths*	0	1	1	2
Later deaths	3	0	2	5
(*a*) Chest disease	(1)		(2) [1 cerebral abscess, 1 bronchopneumonia]	
(*b*) Other causes	(2)			
I.S.Q.	1 (Pul. Tub.)	2 [1 diffuse, 1 collapse]	1	4
Improved†	9 (10 per cent)	2	1 (work 3 yr.)	12 (11 per cent)
Good	75 (85 per cent)	2		77 (73 per cent)
Improved, awaiting further surgery		6		6
	88	13	5	106

* Operative death—any post-operative mortality with unhealed wound.
† Improved—at normal occupation, but some disability.

4. Recurrent bronchiectasis appears within t enty-four months of the original operation and is c used by fibrosis following œdema and infection o the area involved. The precipitating factors a e bronchial, vascular, and lymphatic obstruction, except in rare cases where acute infection or neuro-muscular inco-ordination may initiate the process.

5. Collapse and pneumonitis of the opposite side and congenital abnormalities found at operation do not increase post-operative morbidity.

The other members of the team who are mutually linked in success and failure are: Dr. E. K. Abbott, radiologist; Dr. L. G. Cook, pathologist; Dr. K. J. Powell, anæsthetist; Miss B. V. Slesser, senior registrar; and Sisters Coxhead and Hukin, who have been responsible for the nursing during the period under review.

EXPERIMENTAL SURGERY

AN INVESTIGATION INTO THE VALUE OF NYLON AND TERYLENE AS NERVE SUTURES

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SINCE the studies of Guttmann (1942) two suture materials have been introduced which may have a place in nerve suture. They are nylon and terylene, both synthetic materials of great natural strength. At the request of Mr. H. J. Seddon, Director of the Institute of Orthopædics, we undertook a study of the suitability of these materials for the repair of nerves.

PLAN OF EXPERIMENTS

We investigated: (1) the histological reactions produced by these materials in nerves, (2) the tensile strength of a single interrupted suture of each of the materials, and (3) the tensile strength (i.e., holding power) of the epineurium of human cadaveric nerves.

As controls for the nylon and terylene, we studied simultaneously black silk, human hair, tantalum, and stainless steel. With the exception of stainless steel (0·005 in.) and hair (0·002 in.) all the sutures were of 5 0 calibre; all were mounted on 20-mm. half-c rved, round-bodied, atraumatic needles. Steri-li ation was by boiling.

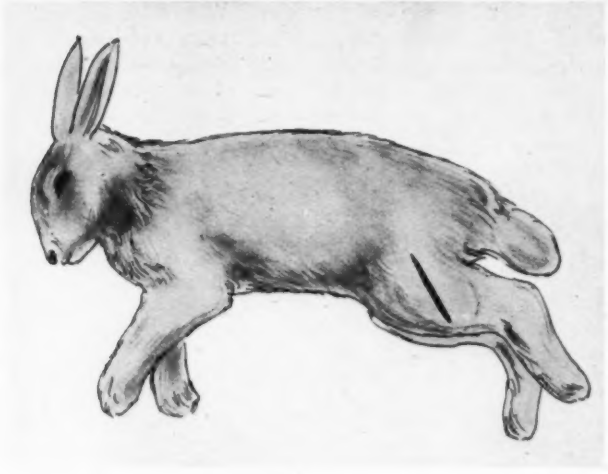
Method of Insertion of Sutures (*Figs.* 407–409).—Under aseptic conditions sutures were inserted into the sciatic nerves of rabbits, according to the technique shown in *Figs.* 407, 408. In one group of 27 animals the suture was placed under the epineurium (*Fig.* 408 B), in another group of 27 animals through the nerve (*Fig.* 408 C), and in a third group of 23 animals the nerve was divided and resutured (*Fig.* 409). The animals were sacrificed on the twenty-first or twenty-second day and the sciatic nerves removed, inspected for naked-eye reaction, and submitted for microscopical study, for which van Gieson's stain was found to be most satisfactory.

Sources of Error.—

a. Removal of Sutures.—It is necessary to withdraw metallic sutures before cutting sections; it is impossible to say how much the tissues are disturbed by this.

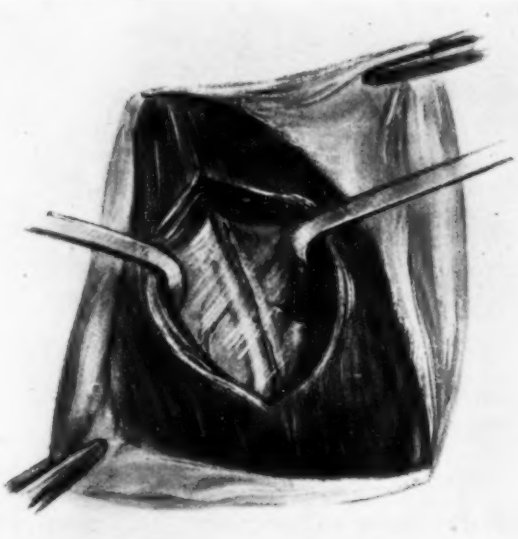
b. Individual Variation.—Although the general patterns of reaction of tissues to the same foreign

material are not varied, they are by no means constant. Since no quantitative method has been devised of assessing the variables in tissue reaction, conclusions drawn from experiments such as these are based on judgement, and it is necessary to examine many sections from several animals before coming to a final opinion.



A

B



C

FIG. 407.—Exposure of the sciatic nerve of the rabbit in the thigh. A, Skin incision. B, Muscles split longitudinally in the direction of the fibres. C, Muscles retracted and layer of thin aponeurotic fascia overlying the sciatic nerve-bundle exposed.

RESULTS OF THE INVESTIGATION

1. HISTOLOGICAL REACTIONS

Three elements in the cellular response may be discerned: (1) an outer layer of adult fibrous tissue arranged concentrically, clearly subserving the function of encapsulation. (2) A layer of mononuclear cells lying within the capsule; their nuclei may be round and dark, or pale and containing pigmented areas. Whether these appearances represent different stages of development of the same cell or different types of cells is a matter of dispute. At all events they fall within the convenient group of histiocyte; it is possible that they may be subserving a phagocytic function. (3) Collections of multinucleated giant cells of the foreign body type with the nuclei arranged around the periphery of the cell, which appear to be attempting to remove the foreign material. Possibly they represent the coalescence of a number of histiocytes, the better to ingest large foreign particles.

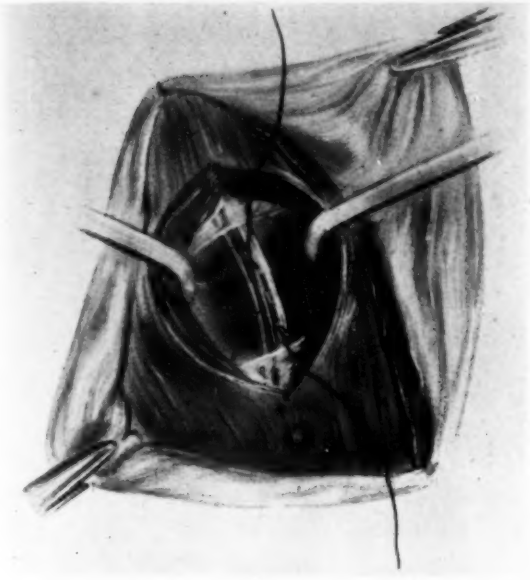
In estimating the severity of tissue reaction to a foreign material, there may be considered: (1) the thickness of the encapsulating zone, (2) the extent of mononuclear infiltration within the capsule, and (3) the presence of foreign-body giant cells. With these as criteria, it is possible to place the sutures studied into two groups:

a. The Metallic Sutures.—Though encapsulation is seen there is little intracapsular infiltration with histiocytes, and foreign-body giant cells are absent (*Figs.* 410, 411). These materials are inert in tissue and cause little cellular reaction.

b. Silk, Nylon, Terylene, and Human Hair.—In the case of each of these suture materials a well-marked cellular reaction is seen within the encapsulating fibrous tissue. Many histiocytes and some giant cells are evident (*Figs.* 412–416). We have not been able to come to any definite conclusion about the relative properties of these four suture materials. They provoke similar tissue reactions and this study does not indicate that the newer materials, nylon and terylene, are in any respect better than silk. Human hair is a little unusual in that foreign-body giant cells and histiocytes are less commonly observed and very little encapsulation is evident (*Fig.* 416).

2. TENSILE STRENGTH OF SUTURE MATERIALS

The tensile strength of single interrupted sutures of the various materials was investigated in the tensiometer (*Table* 1). All the materials except human



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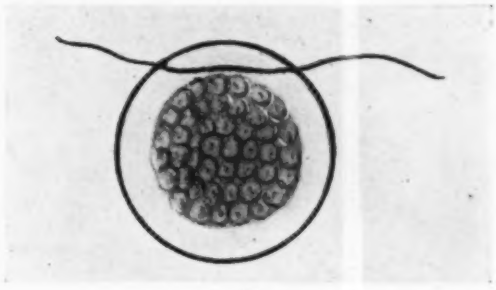
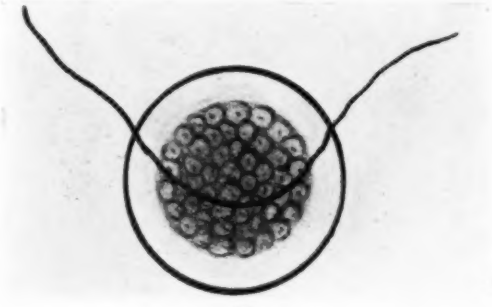


B

FIG. 408.—A, Thin aponeurosis fascia incised and nerve-bundle exposed. Suture material inserted. B, Suture material inserted in epineurium. C Suture material inserted through nerve.



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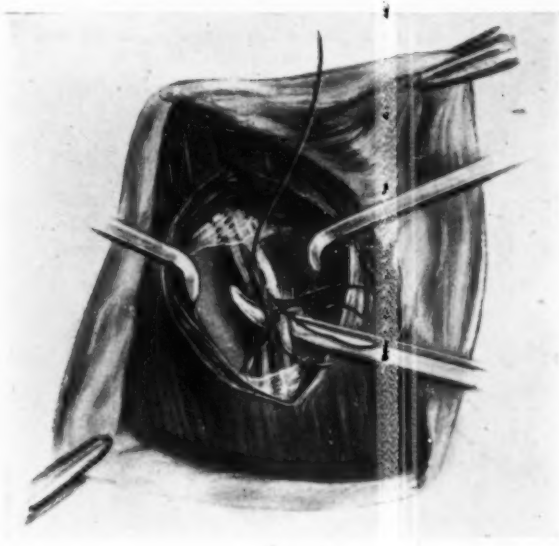

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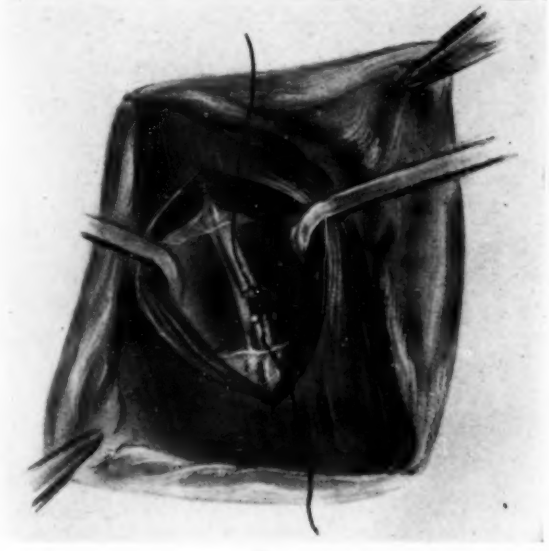

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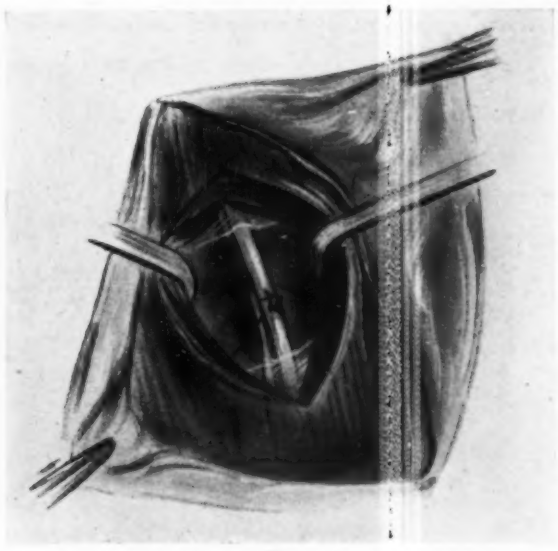
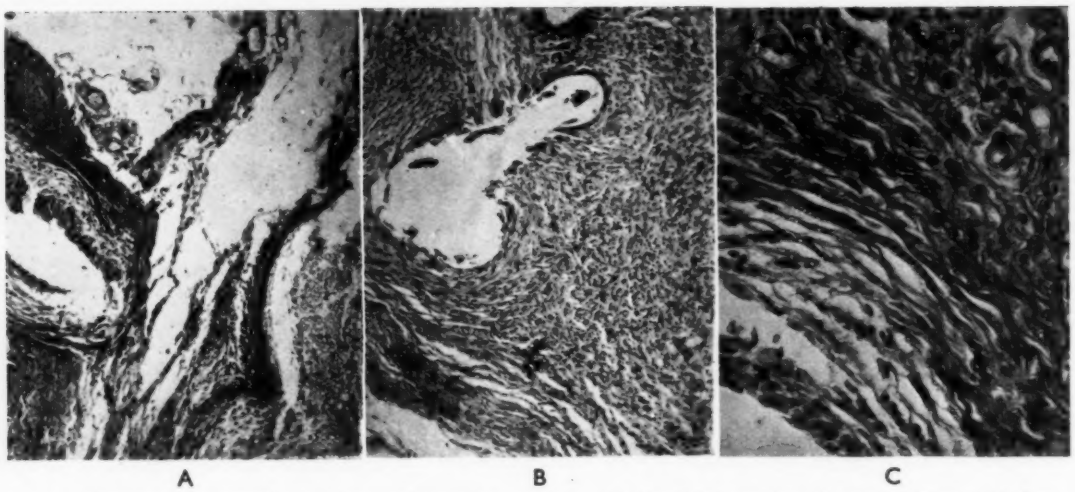


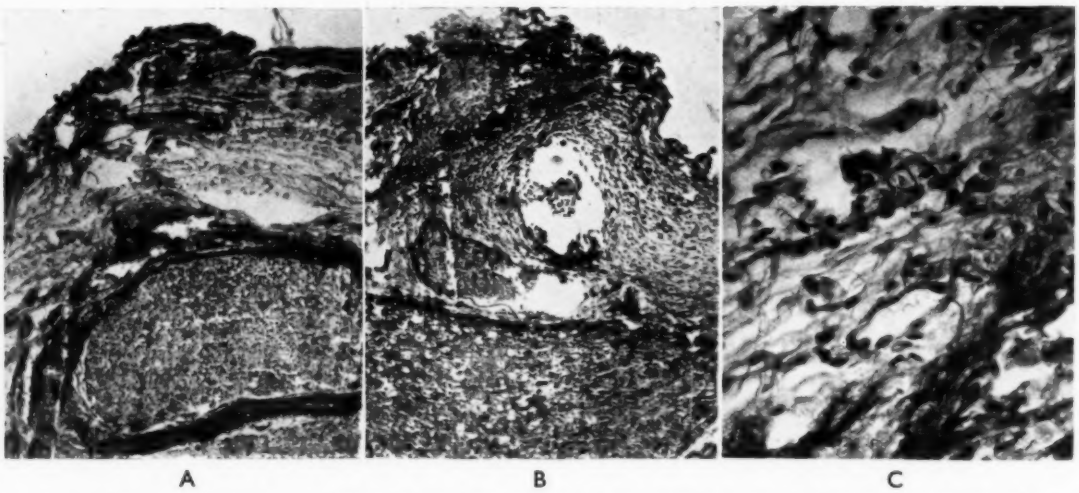
C

FIG. 409.—A, The suture material inserted subepineurially on each side of the intended line of section. B, Division of nerve. C, Suture of nerve.



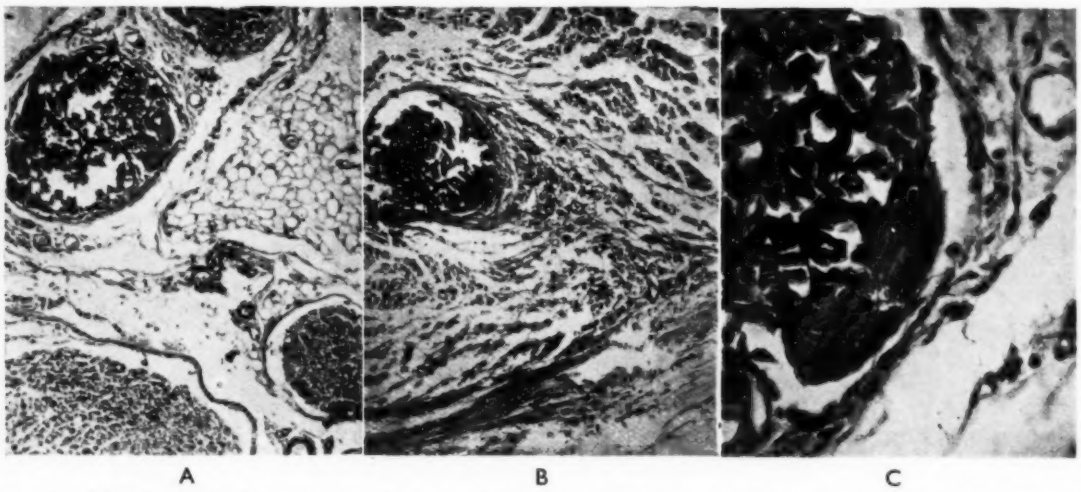
A B C

FIG. 410.—Tantalum wire sutures. A, Epineurial insertion, 21 days. Little cellular reaction within zone of encapsulation. Giant cells absent. (× 60.) B, Transfixion suture, 21 days. Slight cellular reaction in intracapsular space. No giant cells. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Little cellular reaction intracapsularly. No giant cells. (× 240.)



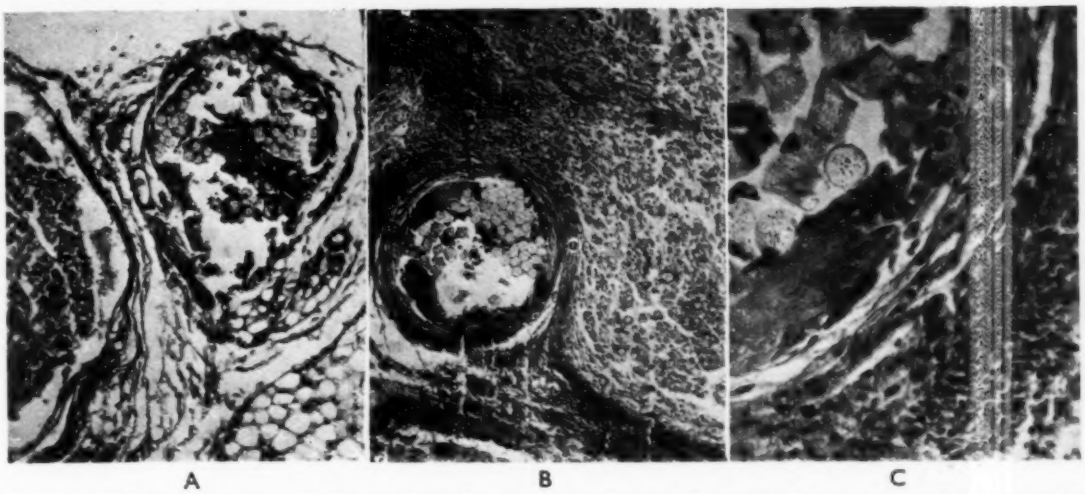
A B C

FIG. 411.—Stainless steel sutures. A, Epineurial insertion, 21 days. Little cellular reaction within zone of encapsulation. Giant cells absent. (× 60.) B, Transfixion suture, 21 days. Slight cellular reaction in intracapsular space. No giant cells. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Little cellular reaction intracapsularly. No giant cells. (× 240.)



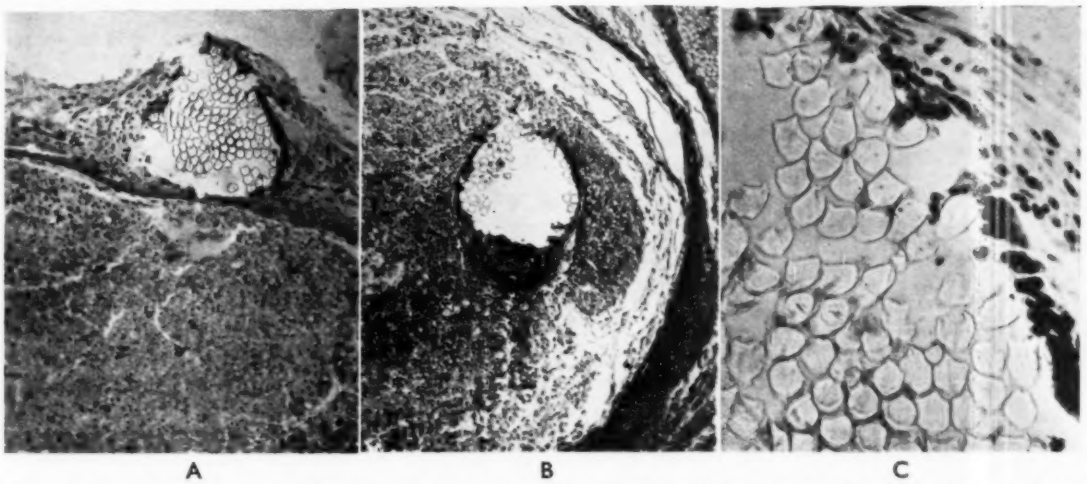
A B C

FIG. 412.—Silk sutures. A, Epineurial insertion, 21 days. Moderate cellular reaction within zone of encapsulation. Giant cells are present. (× 60.) B, Transfixion suture, 21 days. Cellular reaction and giant-cell infiltration of moderate degree in intracapsular space. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Moderate cellular reaction intracapsularly. Giant-cell infiltration. (× 240.)



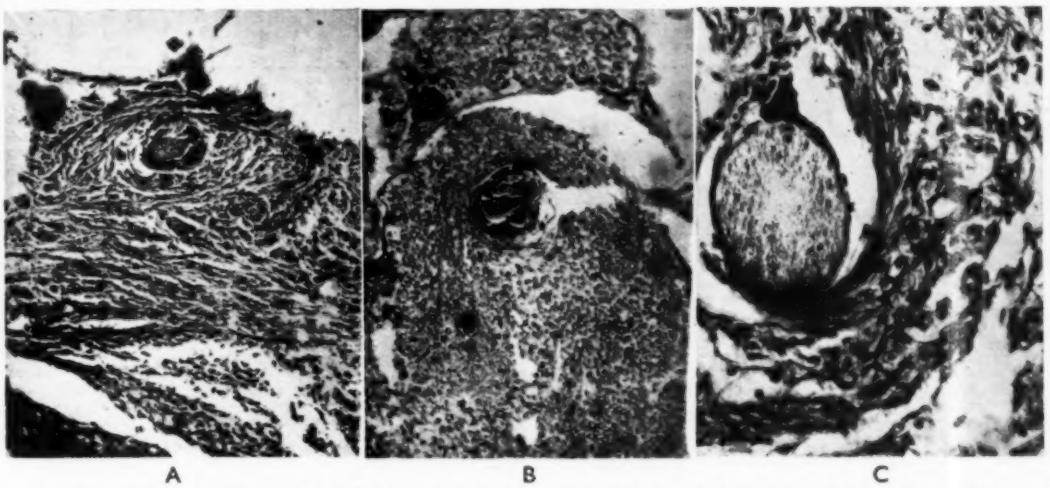
A B C

FIG. 413.—Braided nylon sutures. A, Epineurial insertion, 21 days. Moderate degree of cellular reaction and giant-cell infiltration within zone of encapsulation. (× 60.) B, Transfixion suture, 21 days. Intracapsular cellular reaction is moderate and giant-cell infiltration is present. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Moderate cellular reaction in zone of encapsulation. Giant cells are present. (× 240.)



A B C

FIG. 414.—Terylene sutures. A, Epineurial insertion, 21 days. Intracapsular cellular reaction of moderate degree and giant cells are present. (× 60.) B, Transfixion suture, 21 days. Moderate cellular reaction within zone of encapsulation. Giant-cell infiltration is present. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Intracapsular cellular reaction is moderate and giant cells are present. (× 240.)



A B C

FIG. 415.—Human hair sutures. A, Epineurial insertion, 21 days. Zone of encapsulation not so well marked as in others. Cellular reaction and giant-cell infiltration are present to a moderate degree. (× 60.) B, Transfixion suture, 21 days. Encapsulation not prominent. Cellular reaction and giant-cell infiltration are present to a moderate degree. (× 60.) C, Subepineurial suture of cut nerve-ends, 21 days. Zone of encapsulation not well marked. Moderate degree of cellular reaction and giant-cell infiltration present. (× 240.)

hair show a tensile strength far in excess of that required to hold epineurium together; human hair is much too weak to be of any value in this respect. In other words, the other sutures are much heavier than they need be. There are technical difficulties about making braided sutures finer than size 5/0, but the attempt should be made since the less foreign material there is at a suture line the better.

Table I.—TENSILE STRENGTH OF SUTURE MATERIALS

SUTURE MATERIAL	No.	TENSILE STRENGTH OF SINGLE INTERRUPTED SUTURE			
		Calibre (in.)	Mean Tensile Strength (g.)	S. D.	Standard Error of the Mean
Human hair		0·002–0·003	145	± 20·6	± 9·3
Silk	5/0	0·006 (Approx.)	1120	± 48·9	± 22·6
Terylene	5/0	0·006 ,,	1888	± 18·9	± 8·5
Nylon	5/0	0·006 ,,	1796	± 29·6	± 13·4
Tantalum wire	5/0	0·006 ,,	1426	± 21·9	± 9·9
Stainless steel		0·005	1262	± 37·6	± 17·5

3. TENSILE STRENGTH OF THE EPINEURIUM

In attempting to decide the most suitable size of suture material for nerve repair, it is important to determine the tensile strength or holding power of the tissue into which it is to be inserted. It would be ideal to use sutures with physical properties exactly similar to those of the material to be sutured.

We investigated this point in the following way. At routine post-mortem examinations we removed 5-cm. lengths of the median, ulnar, radial, and sciatic nerves. A single interrupted suture of silk was then

Table II.—TENSILE STRENGTH (IN GRAMMES) OF EPINEURIUM OF HUMAN NERVES

EXPERIMENT	MEDIAN		ULNAR		RADIAL		MEDIAL POPLITEAL		LATERAL POPLITEAL	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
1	480 440	380 430	375 470	380 410	380 350	440 390	390 450	430 470	450 495	380 400
2	460 430 360	360 400 365	370 300 340	400 360 330	370 340 380	300 320 340	300 340 345	380 350 360	330 320 370	370 330 330
3	380 480 400	420 430 480	340 360 340	320 340 380	380 340 340	360 400 360	410 500 460	420 430 420	340 360 400	320 360 300
4	430 430 450	390 380 430	430 380 400	380 340 310	330 310 390	360 320 340	310 310 330	310 380 330	380 330 320	310 370 350
5	440 400 430	380 470 450	380 420 440	440 400 450	420 350 470	470 390 436	370 430 450	430 390 390	350 380 390	390 340 370
6	470 510 480	490 470 470	480 460 500	480 490 480	440 350 460	430 410 490	500 480 450	490 480 450	470 450 470	480 470 450
7	390 410 370	380 370 400	370 360 390	390 390 380	420 380 340	370 360 420	370 420 350	410 440 400	410 370 380	400 440 360
8	440 390 310	410 400 450	360 430 410	400 380 380	390 370 370	450 370 380	350 420 370	360 380 350	340 390 370	370 320 360
9	340 390 370	420 370 370	470 390 410	370 410 370	460 490 430	440 460 430	480 440 410	460 440 440	360 470 410	450 390 440
10	490 450 440	380 420 420	460 450 460	420 370 440	440 480 430	450 440 440	430 410 480	400 490 470	490 490 420	400 440 440
Mean	423	412	405	393	393	412	405	415	403	389
Standard deviation	± 47·95	± 38·72	± 50·5	± 45·82	± 50·4	± 50·99	± 59·16	± 47·95	± 54·77	± 48·95
Standard error of mean	± 8·9	± 7·0	± 9·3	± 8·5	± 9·2	± 9·4	± 10·9	± 8·9	± 10·7	± 9·0
Difference in mean of right and left	11·0		12·0		19·0		10·0		14·0	
Standard error of difference	± 11·4		± 12·56		± 13·15		± 14·07		± 14·0	

inserted through the epineurium ⅓–½ cm. from one end. The other end of the nerve was clamped and traction was made by a tensiometer (Douglas, 1949) until the suture cut out. The test was repeated three times at different points on the epineurium of each nerve.

The tensile strength of the epineurium of these nerves fell within the range 310–510 g., the means being remarkably constant between 389 and 423 g. (*Table II*). There was little scatter in the values between right and left side of the same cadaver. The point arises as to whether the values in cadavers are similar to those in the living subject. We believe that they are likely to be so because examinations were carried out within 24 hours of death and in the interval the cadavers were kept in refrigerators. The relative constancy of the values from cadaver to cadaver also suggests that little change has taken place. While it is impossible to settle the point definitely except by testing the tensile strength of epineurium on the operating table, the balance of evidence indicates that these values are similar to those in living nerves.

4. KNOT-HOLDING PROPERTIES

A square knot joining two pieces of silk holds till the suture breaks, usually immediately adjacent to the knot. In the case of nylon and terylene, however, the knot invariably slips out before the suture breaks, because their highly polished surface reduces the frictional resistance at the bends of the knot. Slipping of the knot also occurs, though to a much less extent, with steel and tantalum. Human hair behaves like silk and breaks at the knot. There is little doubt that from the point of view of knot-holding properties, silk is the best of the available materials.

SUMMARY

1. A series of suture materials (size 5/0) used in nerve repair was studied with reference to tissue reaction and physical characteristics.

2. The metallic sutures provoke least tissue reaction but their tendency to kink and to break makes them difficult to handle.

3. Black silk, terylene, nylon, and human hair all produce a histiocytic and giant-cell response, and from the present observations it is not possible to discriminate between them.

4. All the sutures, except hair, are heavier than they need be for the task of holding epineurium together.

5. In our opinion, silk of a calibre of 5/0 is still the best available material for nerve suture. Its calibre could with profit be further reduced.

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SHORT NOTES OF RARE OR OBSCURE CASES

STRANGULATED FEMORAL HERNIA SIMULATED BY FAT NECROSIS EXTERNAL TO HYDROCELE OF HERNIAL SAC

BY C. W. D. LEWIS

ASSISTANT IN THE SURGICAL UNIT, WELSH NATIONAL SCHOOL OF MEDICINE, ROYAL INFIRMARY, CARDIFF

THE following case is apparently rare.

CASE REPORT

S. R., a housewife aged 49, was admitted as an emergency complaining of a tender swelling in the left groin. Her health had been good prior to a miscarriage which had occurred between two and three years previous to her admission: following this miscarriage there was a period of ill health during which she lost weight and noticed for the first time the presence of a swelling in the left groin. The mass varied in size, but never disappeared. Occasionally it was associated with local tenderness and pain of mild degree referred to the abdomen and the left thigh. These attacks were accompanied by nausea but no vomiting. In the eight days previous to admission, the symptoms gradually became more severe, the mass harder and larger.

Examination revealed a tense and tender left femoral hernia which was irreducible. At operation the neck of the sac was exposed through an incision above Poupart's ligament. In front of the neck as it passed into the femoral canal a greyish, avascular column of extraperitoneal fat was seen and this, too, passed into the canal. After an ineffective attempt to reduce the sac from above, the latter was exposed below the femoral canal. Here it was seen to be tense, congested, and adherent to surrounding tissues. In front of the sac and indenting it anteriorly was the continuation of the extraperitoneal fat, protruding from the femoral canal, firmly fixed, the size of a raspberry, dark and gangrenous in appearance.

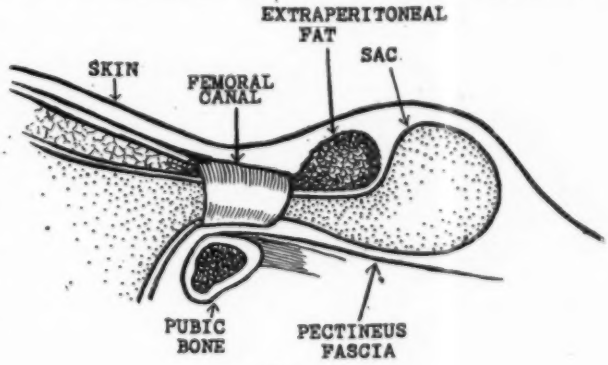

FIG. 416.

The accompanying diagram (*Fig.* 416) gives approximate outline of the tissues concerned.

The whole of the fatty tissue was removed, the sac, which was shut off at its neck and contained only fluid, was excised and its neck ligated. The canal was closed from above by suturing. Convalescence was uneventful.

A LARGE TRAUMATIC ANEURYSM OF THE HEPATIC ARTERY

By MILROY PAUL

PROFESSOR OF SURGERY, UNIVERSITY OF CEYLON

INJURIES of the hepatic artery, or of its branches, in the course of surgical operations on the gall-bladder or on the main bile-ducts, have received adequate notice in the literature. The classical researches of Flint (1923) on the anomalies of the hepatic artery and of its branches, and the careful reviews by the same author, (1923), by Eisendrath (1920), and by Hans Kehr (1913), of operative injuries of the main bile-ducts, focused attention on the need for careful dissection and good visualization during operations in this region.

Post-operative aneurysms of the hepatic artery are great rarities. Küntscher (1937) recorded a case

FIG. 417.—Sketch of view at operation showing the thick-walled sinus leading to the fundus of the gall-bladder. The large spherical aneurysm on the medial side of the gall-bladder is seen.

of a post-operative aneurysm of the hepatic artery following cholecystectomy. No case has been recorded of the successful repair of an aneurysm in this region by the operation of restorative endo-aneurysmorrhapy, and the present case of post-operative aneurysm is recorded on that account and because of its unusual features of interest.

Reference must be made to the case of Gordon-Taylor (1943) of a patient with an infective aneurysm of the hepatic artery on whom a technically perfect restorative endo-aneurysmorrhapy was done. Althouth the patient died forty hours later, a post-mortem showed no failure of the repair of the aneurysm. Ligature of the hepatic artery might be the only means of arresting the hæmorrhage from an aneurysm, but such an operation is fraught with grave danger to life. In 12 cases in which ligature of the hepatic artery was done for aneurysm, there was a mortality of 75 per cent, and in 2 of the surviving 3 cases there was no certainty that an aneurysm was present (Gordon-Taylor, 1943).

The hæmatemesis and melæna of the case now reported bears out the contention of Malloy and Jason (1942) that the most characteristic features of a hepatic aneurysm are not a deep-seated pulsatile swelling, but pain, hæmorrhage, and sometimes jaundice, the hæmorrhage most often manifesting itself by hæmatemesis and melæna.

CASE REPORT

D. B. T., a Sinhalese male cultivator aged 38, was admitted to the General Hospital, Colombo, on June 1, 1950, on account of bleeding from a sinus in a scar on his abdominal wall. At the time of admission this patient was remarkably pale, the pallor of his lips, and the whiteness of his conjunctivæ being very striking. He had a pulse-rate of 120. A vertical right upper abdominal operation scar was seen, with a sinus in it the diameter of a slate pencil. Blood-stained serum was oozing from this sinus. Two months previously (March 29) this patient had been operated on at a neighbouring provincial hospital for abdominal pain of twelve days duration. The wound had been drained for twelve days. He had left the hospital twenty-one days after the operation. Two days later he had vomited old blood-clots and there was a discharge of blood from a sinus which had formed at the site of emergence of the drainage-tube from the abdominal wall. He was re-admitted to the same hospital and left twenty-one days later with the sinus healed. However, two days later he again vomited blood, and on this occasion he also passed blood in the stools. The sinus also discharged blood, and this bleeding had continued. He had now come for treatment at the General Hospital, Colombo. The marked pallor of the patient, and the persistent ooze of blood-stained serum from the sinus, suggested the possibility that this patient might have some hæmorrhagic diathesis. It was considered possible that the previous operation might have been undertaken for pain due to bleeding into the lumen or walls of the bowel. The patient was referred to Professor P. B. Fernando for an investigation of the condition of his blood.

Professor Fernando reported that the blood showed no abnormality which would account for persistent bleeding. His more significant findings were :—

R.B.C.	2,370,000 per c.c.
Platelets	120,000 per c.c.
Reticulocytes	1·2 per cent
Hæmoglobin	40 per cent
Bleeding time	2½ minutes
Clotting time	¼ minute

Anisocytosis, poikilocytosis, and pessary forms were seen.

Hess' capillary test, negative.

A radiograph after a barium meal revealed no abnormality of stomach, duodenum, or intestines. As the bleeding from the sinus on the anterior abdominal wall continued to be quite appreciable, surgical operation was decided on.

AT OPERATION.—On June 23, under light percaine spinal anæsthesia, an incision was made through the scar of the previous operation, enclosing the sinus within a small ellipse. The peritoneal cavity was opened and found to be clean and dry. A thick cord the diameter of a pencil led from the sinus on the anterior abdominal wall to the fundus of the gall-bladder. The gall-bladder was white, thick-walled, and shrunken. At the porta hepatis there was a mass, the size of a billiard ball, which was apparently the basal part of the gall-bladder (*Fig.* 417). While this mass was being dissected its walls crumbled,

nd there was a torrential flow of blood. The friable alls of the mass were rapidly wiped away, and a gauze lug was pressed on to the bleeding area. When the leeding had been abated by this measure, and some egree of visibility had been regained, the gauze plug as cautiously removed. Bright red blood spurted om two holes in the bed which had been occupied by e friable mass. These holes were each the diameter of slate pencil (*Fig.* 418). The bleeding was again rrested by accurate placement of a smaller gauze plug ver these holes. The holes lay to the left of the common ile-duct, which was clearly visible at this stage. The all-bladder was now seen to be attached by a thin strand hich was the greatly attenuated cystic duct, and when is had been ligatured the gall-bladder was removed. he gauze plug over the two holes was now lifted off nd the holes were clamped with artery forceps. It was alized that these two holes were directly over the line f the hepatic artery, and care was taken to clamp the

FIG. 418.—Sketch of view at operation after removal of the gall-bladder and of the friable walls of the aneurysm. The orifices overlying the hepatic artery and the fistula on the anterior wall of the duodenum are depicted. The common bile-duct is a prominent structure.

edges of the holes without grasping so deeply as to endanger the continuity of the underlying hepatic artery. When this had been done, it was observed that hæmostasis was complete. The two holes were closed by ligature. A small hole was now noted on the anterior wall of the duodenum (*Fig.* 418). It was the diameter of a slate pencil and it was closed by suture. The abdominal wound was sutured without drainage. Much blood had been lost by this time, and the transfusion which had been started during the operation was continued till a pint of blood had been administered.

On the next day the patient had a pulse of 120. His abdomen was distended and he was uncomfortable. The stomach was drained by a Ryle's duodenal tube, passed through the nose, and this drainage was continued for four days as foul bile-coloured liquid continued to flow from this tube for this time. The patient's condition improved after this, and he left hospital on July 18 with his wounds healed and feeling quite well.

THE SPECIMEN (*Figs.* 419, 420).—This consisted of the sinus track and the gall-bladder. The gall-bladder walls were a quarter of an inch thick and fibrosed. The lumen of the gall-bladder was filled with red blood-clot. At the base of the gall-bladder the wall was thin and there was a hole in its walls at this place 1 in. in diameter which had been occluded by the spherical mass at the porta hepatis. The edges of this hole in the gall-bladder were smooth and fibrosed and the clot within the gall-bladder was continuous with the clot within the spherical mass.

The sinus tract was thick-walled and made of dense fibrous tissue. Its lumen was the diameter of a slate pencil and it led from the fundus of the gall-bladder to the skin of the anterior abdominal wall.

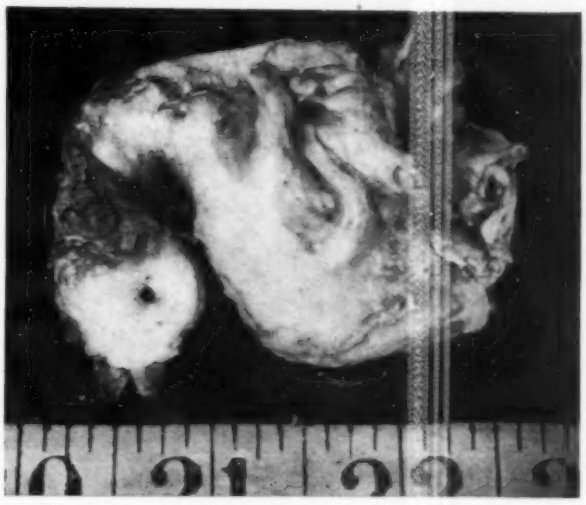

FIG. 419.—Photograph of specimen removed at operation showing the gall-bladder and the sinus from its fundus. The sinus tract, which has been cut across, shows with its cut surface facing forwards.

Commentary.—A definite diagnosis had not been made when an exploratory laparotomy was decided on in this case. There was persistent bleeding from the sinus, and the object of the operation was to determine its source.

During the operation, the necessity for dealing with an alarming flow of arterial blood prevented much thought

FIG. 420.—Another photograph of the same specimen, showing the cut faces of a section into the thick-walled gall-bladder.

being given to the underlying pathology of the case. When the clinical findings and the appearances at the operation were subsequently reviewed, the conclusion seemed irrefutable—that there was a large traumatic aneurysm of the hepatic artery. The encapsulated spherical mass of friable blood-clot with a central core of fluid blood which was fed with fresh arterial blood through two orifices in its posterior wall could only be an aneurysm. The trunk of the hepatic artery was immediately below the orifices feeding the aneurysm with blood. The blood-clot within the aneurysm extended through a hole one inch wide in the wall of the gall-bladder, and the blood had a path to the exterior through the sinus leading from the fundus of the

gall-bladder. The continued leak of blood from this sinus nearly two months after the first operation showed that there was a feed of fresh blood to the central core of the clot and this blood had seeped through the clot to the exterior through the sinus.

The sinus from the fundus of a scarred gall-bladder to the anterior abdominal wall, at the site at which a drainage-tube had been previously inserted, made it evident that at the first operation the gall-bladder had been drained. Had an attempt been made to excise this gall-bladder and had this attempt been abandoned on account of bleeding resulting from this dissection? It seems very likely that this was the case. The vomiting of blood-clots on two occasions after the first operation and the passing of blood per rectum on the second of these occasions makes it evident that the aneurysm had bled into the duodenum, and it is likely that this occurred through the orifice seen in the first part of the duodenum when the aneurysmal walls were wiped away. Altogether a fascinating set of deductions. A mass of encapsulated clot at the porta hepatis walling off two holes in the hepatic artery, a large hole on the wall of the gall-bladder, and a hole in the wall of the duodenum, saving the patient from three operative injuries, any one of which could have been sufficient to determine his death.

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AORTIC EMBOLECTOMY

REPORT OF A SUCCESSFUL CASE

BY P. G. DALGLEISH AND E. E. T. TAYLOR, NORTHAMPTON

THE following is an account of a successful operation for embolism of the aortic bifurcation :—

On May 19, 1949, a man aged 55, a boot-and-shoe operative, was admitted as an emergency to Northampton General Hospital. He complained that 3 hours previously he felt something " give " in the small of his back while at work. Following this there was severe and continuous pain in the lumbar region with numbness and loss of power in his legs.

His past history included a stay of 6 months in hospital two years previously with congestive heart failure and probable left ventricular failure. For the past year he had been at work, but had had intermittent claudication in the left leg and could only walk a short distance.

ON EXAMINATION : Patient pale, shocked, sweating. Femoral pulses absent. Able to move thighs but not legs, feet, or toes. Hypo-algesia in thighs. Absolute anæsthesia at level of ankles. The heart was a little enlarged. There was no evidence of valvular disease. The blood-pressure was 170/80. The rhythm was regular. The radial arteries were not unduly thickened.

A diagnosis of riding embolus of the aorta, or possibly dissecting aneurysm, was made. 10,000 units of liquemin were given intravenously.

OPERATION (E. E. T. T.) : Under general anæsthesia, 4 hours after the first symptom.

Long, low, left paramedian incision. Trendelenburg tilt. Intestine packed upwards. Riding embolus of the aorta found. Posterior parietal peritoneum incised and aortic bifurcation exposed. Tapes passed round common iliac arteries and tied in a half hitch over rubber tubing. Aorta occluded above clot by tape tied in a half hitch over rubber tube and controlled by the assistant.

An inch-long incision was made longitudinally in the aortic wall, which was perfectly healthy, and a large pale blob-shaped clot, two inches across and with no " tails ", was removed. The aortic tape was momentarily released, and a ferocious jet of blood showed that the passage was clear. The iliac tapes were temporarily loosened in turn and a continuous welling up of blood showed them to be patent.

The aortic incision was sutured with a running mattress of 5–0 silk returning as an over-and-over stitch to be tied at the point of commencement. The iliac tapes were released first, then the aortic tape, and immediately the right dorsalis pedis and posterior tibial arteries could be felt; on the left side the popliteal could be felt. The abdomen was then closed.

The operation lasted 55 minutes and no special difficulties were encountered. The patient's condition on return to the ward was good. Liquemin 6000 units four hourly was given. The post-operative course was stormy in the extreme, the patient suffering from none of the usual complications but from a host of unexpected ones.

On the first day there was dyspnœa, with many rhonchi in the chest. Blood collected in the wound and the liquemin was therefore stopped. On the second day there was marked abdominal distension with vomiting of black fluid. Retroperitoneal hæmatoma, aortic leakage, or mesenteric embolism were feared, but not substantiated. On the fifth day diarrhœa occurred and the distension improved. On the eleventh, distension recurred; this time due to clear fluid, several pints of which were drawn off by paracentesis on the fifteenth day. On the fortieth day, a sacral bedsore was healing well. On the forty-third, a painful herpes zoster developed in the 11th left dorsal segment. He was discharged from hospital on the sixty-eighth day wearing a supporting belt on account of marked divarication of the recti muscles due to his prolonged distension.

The patient was last seen 17½ months after the operation. He had been at his previous work for nearly a year in the boot-and-shoe trade, working all day on his feet preparing soles. He was able to walk a quarter of a mile before being stopped by the pain in his left foot and shin. He stated that he felt in better health than before the operation (*Fig.* 421).

There was no evidence of cardiac failure, valvular disease, or auricular fibrillation. The blood-pressure was 160/90. He appeared to be in good general health. Peripheral arteries were palpable in the right leg down to the posterior tibial and dorsalis pedis, and in the left leg down to the popliteal (exactly the same as on the operating table immediately after embolectomy). He was wearing a belt for the divarication of his recti muscles.

DISCUSSION

There is a close relationship between heart disease and embolism and a large proportion of reported cases have shown cardiac lesions. The auricular

fibrillation associated with rheumatic heart disease is blamed for most emboli and all are aware of the danger from the use of quinidine in trying to restore normal rhythm. Digitalis, also, has been blamed by de Takats (de Takats, Trump, and Gilbert, 1944), and Reynolds (Reynolds and Jirke, 1944). Garvin (1942), in a review of 771 autopsies on consecutive cases dying from heart disease, found that 265 of them had one or more intracardiac thrombi. Eighty-five patients had thrombi in the left ventricle, fifty-nine in the right auricle, and only 17 patients had thrombi in the left auricle. Of the cases of coronary artery disease with infarction, two-thirds of the cases had mural thrombi. Cases of hypertension, rheumatic heart disease, and those of coronary disease without infarction, each had mural thrombi in about one-third of their number. Auricular fibrillation seemed to be significantly related to the formation of thrombi only in the rheumatic group and not in the ischæmic cases. Mackechnie and Allen (1935) reported 46 cases of arterial emboli and in 41 of them heart disease was present. Ravdin and Wood (1941) report the case of a young man of 32 who had a myocardial infarction and ten days later an embolus lodged at the aortic bifurcation and was successfully removed. Fry (1939) in reports of some cases describes a man who had several attacks suggesting arterial embolism, one ultimately proving fatal; several years previously he had had a myocardial infarction.

Emboli frequently lodge at arterial bifurcations, and the bifurcation of the aorta is not immune. Secondary thrombosis may spread upwards and downwards from the lodged embolus. The main symptoms of an aortic occlusion are sudden pain in the lumbar region, rapidly progressing weakness of the legs and impaired or absent sensation from about the mid-thigh downwards. Cramps and paræsthesiæ in the legs are frequent. The lower limbs are usually cold, pale, and may be mottled blue. The arterial pulses in the legs are absent and even the lower aortic thrust may not be palpable. Whereas in the presence of known heart disease and these physical signs the diagnosis is obvious, yet where there are no symptoms of heart disease it may easily be overlooked initially. The frequency with which the diagnosis of sudden arterial occlusion is made parallels the suspicion that it may exist. Dissecting aneurysm of the aorta, and arterial spasm occasionally found in association with acute thrombophlebitis, are the two important conditions to be distinguished from aortic thrombo-embolism.

In this case the patient was sent to hospital with a diagnosis of paraplegia. He had no obvious signs of heart disease and did not give the story of his previous stay in hospital two years before or of intermittent claudication until asked directly about his cardiovascular system. After recovery, clinical, radiological, and electrocardiographic examination of the heart failed to show any valvular disease, aneurysm of the aorta, or recent cardiac infarction. It seems possible that the previous cardiac failure was due to a myocardial infarction and that the intermittent claudication during the year before this embolism may have been due to a previous embolus into the left popliteal artery. This is similar to the case reported by Fry (1939). Primary thrombosis of the aorta was ruled out at operation and the vessel wall was seen to be healthy.

Twenty-six "cures" have previously been reported after aortic embolectomy (Albright and Leonard, 1950), and thirteen other patients have survived operation (*Lancet*, 1950).

Since "riding" embolus of the aorta is very uncommon, and the prospect of recovery without operation is small, the chances are that a surgeon

FIG. 421.—The patient 15 months after aortic embolectomy.

confronted with the condition will be obliged to embark on aortic embolectomy without special instruments and without any previous experience of the operation. Such was the case in the present instance, in which the simplest and most direct attack appeared to be the best.

Death following aortic embolectomy is most likely to come from shock, cardiac failure, further emboli (*Lancet*, 1950) or subsequent gangrene (Keeley, 1948). Fortunate features of the present case were (1) absence of heart failure and further emboli, (2) early operation (four hours after the first symptom) and (3) a healthy aorta.

Procedure.—Urgent operation is indicated provided the patient stands a reasonable chance of survival, and it is submitted that measures directed towards trying to get the clot to shift may waste

valuable time and even dislodge parts of it to less accessible positions.

As to approach, " the transperitoneal has, we believe, the advantage of simplicity . . . " (Ewing, 1950), and H. Wilson (1949) also prefers a direct approach. We fully concur. In the absence of special instruments, clamps, etc., we found that the " tape and tube " method was simple and satisfactory.

It will be noted that the iliac tapes were tightened before the aorta was occluded and incised. Perhaps this was wrong, as they might have cut off any " tail " proceeding distally from the clot (*Lancet*, 1950). Fortunately, this clot had no " tails ". On the other hand, manipulation of the aorta may result in migration of clot to distal inaccessible positions, unless the iliac vessels are compressed first (Linton, 1945).

There seems no objection to incising the aorta itself, and there is no narrowing after suture. This is hard to prevent if one of the common iliac arteries is incised and may seriously impair the circulation (Ewing, 1950). It must also greatly increase the risk of subsequent thrombosis.

Through the aorta, clot can be milked out gently and with a minimum of " fishing ", with less likelihood of loss of pieces of clot and of intimal trauma.

The surgeon can also take comfort from the fact that suture of the aortic incision must be infinitely easier than suture after excision of a coarctation which is being done repeatedly with success.

Heparin has been advised post-operatively to keep the clotting time at 15 minutes for 3 days (Murray, 1943). This increases the risk of bleeding from the operation area, but should heparin not be used, an aortic incision should be less likely to give rise to clot than one made in an iliac artery.

Our thanks are due to Dr. Eric Shaw, under whom the patient was admitted, and to Dr. T. A. Richard for help in the follow-up. Also to Mr. J. H. C. Phillips for valuable suggestions during the operation.

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ADENOCARCINOMA OF THE APPENDIX

BY J. HOWELL HUGHES, LIVERPOOL

ONLY in comparatively recent years has it been recognized that the term primary carcinoma covers two types of neoplasia of the appendix. The commoner is the " carcinoid " or argentaffin carcinoma, and the other, adenocarcinoma. Uihlein and McDonald (1943) suggested that there were three types by subdividing carcinoma of the appendix into " carcinoid ", cystic, which is comparable to cystadenocarcinoma of the ovary in producing pseudomyxoma peritonei, and the colonic type which is similar to adenocarcinoma situated elsewhere in the large bowel. It is however debatable, as Willis (1948) has pointed out, that the pseudomyxoma peritonei is the result of a neoplasm of the appendix but that it may result from the obstructive lesion associated with the neoplasm.

The argentaffin types are found accidentally at operations or post-mortems, being of themselves symptomless. The tumours are usually small, firm circumscribed nodules, often of yellow colour, sometimes multiple, situated in the wall of the appendix, and they may protrude into the lumen or on the peritoneal surface. As a rule they resemble a benign neoplasm but on a few occasions metastases in the regional lymph-glands and liver have been reported.

Adenocarcinoma of the appendix may be of polypoid or ulcerative type and the majority of the few described have been situated in the proximal third of the appendix and symptoms have arisen as the result of obstruction to the lumen with or without inflammation. The condition was usually diagnosed as an inflammatory or obstructive appendicitis or possibly an appendix abscess and the underlying neoplasm only discovered at operation. In view of the small size of the lumen of the appendix and resultant early obstructive signs, diagnosis is comparatively early as compared with a neoplasm of the rest of the large bowel and the prognosis therefore is good. Despite the fact that some have suggested excision of the appendix with at its base a portion of the cæcal wall, the treatment should be that of adenocarcinoma of the cæcum, consisting of right hemicolectomy with removal of the regional lymph-glands.

CASE REPORT

A female patient, aged 40, complained of recurrent attacks of acute colicky pains of twenty-four hours' duration. These lasted about ten minutes and were followed by complete freedom for about two or three hours. The site of the pain was the upper abdomen above the umbilical plane, there was no nausea or vomiting, and there was a bowel action with the first attack of pain. There was no previous history of any similar abdominal trouble.

ON EXAMINATION.—Her general condition was good, she was well nourished, and her tongue was clean. Her pulse and temperature were both normal. There was

nothing abnormal to be seen on inspection of the abdomen, nd on palpation there was some initial muscular rigidity n the right iliac fossa which quickly disappeared with

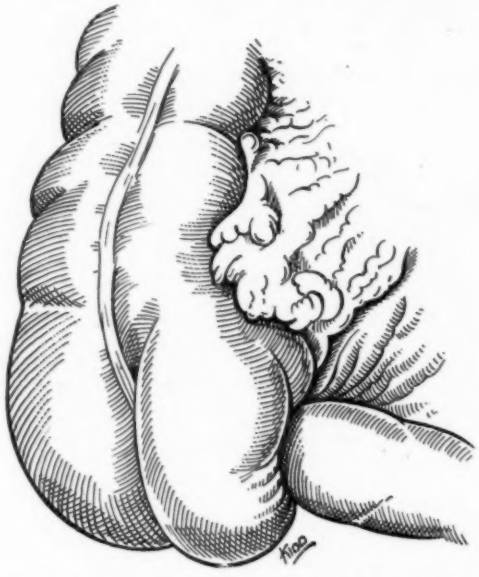

FIG. 422.—This diagram illustrates the condition first seen at operation; the ileum being intussuscepted into the cæcum.

pressure indicating that it was of a voluntary protective nature. There was no area of tenderness or any mass palpable. At the end of the abdominal examination the

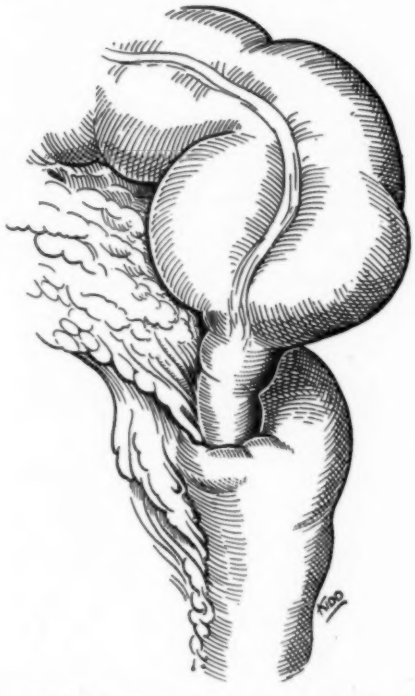

FIG. 423.—This shows what was seen after reducing the ileo-cæcal intussusception and lifting the cæcum over towards the midline, putting the appendix on tension. The appendix appeared as if anastomosed to the ileum and at this site there was a definite soft mass to be felt inside the lumen of the ileum.

patient stated that the pain was recommencing, but this only lasted less than a minute, and on further examination there was no change in the condition of the abdomen. In view of the absence of abdominal signs and a normal pulse and temperature, it was decided to keep her under observation. She was free from pain for a period of twelve hours, but it then recommenced, becoming more severe, the attacks lasting longer and coming more frequently. She was re-examined, and on palpation there was a suggestion of a lump high up in the right iliac fossa. There was no nausea or vomiting, and the pulse and temperature remained normal. In view of the

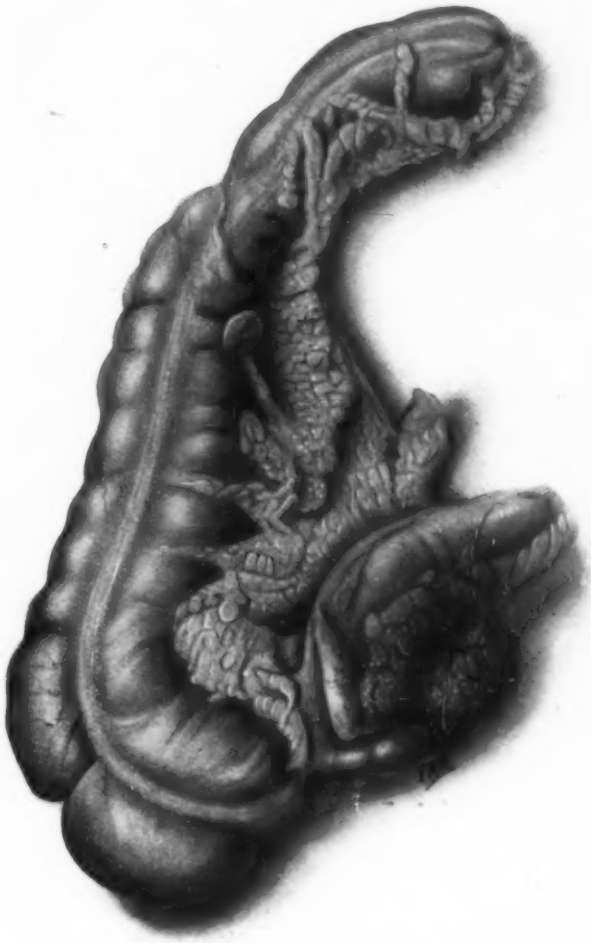

FIG. 424.—Painting of the resected portion of the bowel immediately after removal. This was the condition seen when the appendix was pulled from the ileum and on which the decision to carry out a right hemicolectomy was made. The distal half of the appendix was completely replaced by a papilliferous tumour which came out of the lumen of the ileum. The central depression in the tumour was continuous with the lumen of the ileum and also with that of the appendix.

increased severity of the symptoms it was decided to carry out a laparotomy.

OPERATION.—The abdomen was explored through a right paramedian incision, a little pale free fluid escaped and a mass was found in the right iliac fossa. On bringing the mass into the wound, it was found to consist of an intussusception of the ileum into the cæcum (*Fig.* 422). The ileum was gradually eased out of the cæcum, and then it was found that the appendix was intussuscepted into the ileum, and the terminal inch and a half of the ileum was dilated and on palpation felt to be more "solid" than normal (*Fig.* 423). The appendix was then gradually eased out of the ileum, and the condition shown in *Fig.* 424 was seen. The terminal third of the appendix consisted of a papilliferous

mass which had eroded its way into the ileum, thus forming an appendico-enterostomy. There were some palpable glands in the mesentery along the ileo-colic artery, as well as a small gland in the mesentery of the appendix. In view of the typical malignant appearance of the mass in the appendix, a right hemicolectomy was performed, a side-to-side isoperistaltic anastomosis between the ileum and the mid-third of the transverse colon being carried out. The right iliac fossa was drained by a stab incision low down, and the wound was closed without drainage.

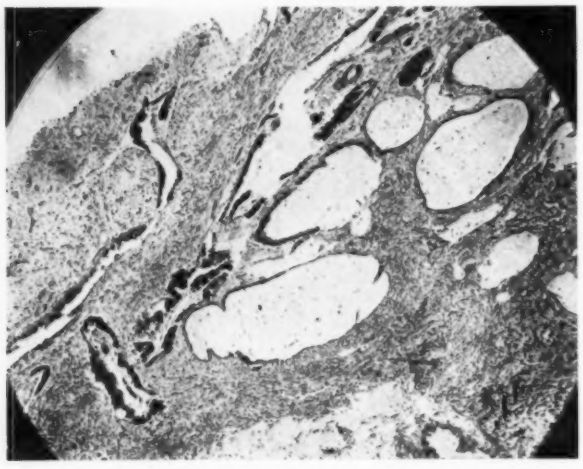

FIG. 425.—Section of wall of appendix at macroscopic edge of tumour, showing infiltration of wall by mucinous adenocarcinoma. (× 37·5.)

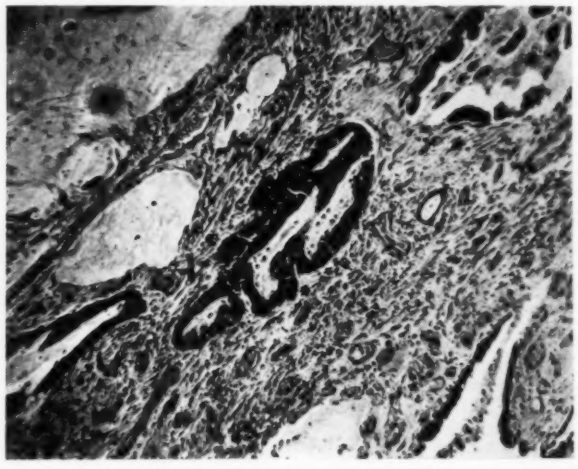

FIG. 226.—Irregular glandular structure of the adenocarcinoma with cystic spaces containing mucin. (× 150.)

Her post-operative convalescence was uneventful and she was discharged home on the fourteenth day following the operation. She has been seen recently, five years following the operation, and is perfectly fit and well.

PATHOLOGY.—

Macroscopical Appearance.—This is well demonstrated in *Fig.* 424, where the papilliferous tumour can be seen involving the distal portion of the appendix. The size of the tumour can be judged by comparison with the size of the ileum.

Microscopical Appearance.—The section revealed a typical invasive adenocarcinoma of the appendicular wall (*Figs.* 425, 426).

COMMENT

A review of the literature reveals that primary adenocarcinoma of the appendix is an extremely rare tumour. Young and Wyman (1942), in reporting a case, found that in their opinion only 4 true cases of carcinoma exist in the literature of the previous ten years. Uihlein and McDonald (1943) reviewed the published reports of the Mayo Foundation and carried out further microscopical examinations on 144 cases previously diagnosed as carcinoma of the appendix and found that of these, 5 specimens only were definite primary adenocarcinoma. Willis (1948) reports having seen 2 cases. Lesnick and Miller (1949) collected 12 verified cases and added 5 of their own. Of these 17 cases, 10 presented as appendiciti or one of its complications, in another 5 the conditio of the appendix was found during laparotomy per formed for some other lesion, 1 was thought to b carcinoma of the uterus—the uterus, tubes, ovary and appendix being removed—and the last one wa diagnosed at post-mortem examination for malignan masses in the plevis. More recently Marks an Whitaker (1950) reported a further case which presented as an appendix abscess. There is no incidence in the literature of a pre-operative diagnosis of adenocarcinoma of the appendix. The case reported above differs from all those previously published as it presented as intestinal obstruction.

It can be conjectured that the growth commenced in the distal portion of a pre-ileal appendix becoming attached to the ileum, eroding through the latter, and the papilliferous growth then acting as a foreign body in the ileum causing first the appendico-ileal intussusception and this in turn being intussuscepted through the ileo-cæcal valve.

SUMMARY

A case of primary adenocarcinoma of the appendix forming an appendico-ileostomy and in turn an appendico-ileo-cæcal intussusception is reported.

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AN UNUSUAL CASE OF INTUSSUSCEPTION FOLLOWING INGESTION OF SEWING NEEDLES

By R. SPENCER, Liverpool

The following case-history is sufficiently unusual and interesting to justify recording.

CASE REPORT

The patient (J. G.) was a male, aged 26 years. He was a low-grade imbecile and of poor physique. A satisfactory history was unobtainable.

He was first admitted to St. James's Hospital, Leeds, on Feb. 7, 1940, on account of the passage of fresh blood in his stools. How long he had been suffering from melæna was not known. Examination by sigmoidoscope demonstrated marked œdema and ulceration of the rectal mucosa. The aetiology was not discovered and no specific organisms were isolated. Local treatment was impossible through lack of co-operation. His condition, however, improved and he was discharged on May 7.

The patient was re-admitted to hospital on the evening of March 12, 1942. He had been vomiting during the day and although no satisfactory history could be obtained from him it seemed likely that he had also suffered from abdominal pain. The medical practitioner who saw him outside suggested the diagnosis of subacute intestinal obstruction.

When he was examined, soon after admission to hospital, he lay curled up on his side holding his abdomen with both hands and groaned continuously as if in pain. He was pale, apparently undernourished, and anæmic. With difficulty he was persuaded to lie on his back. There was moderate distension of the abdomen. The respiratory excursion was somewhat impaired. On palpation there seemed to be generalized tenderness and muscle guarding. The rectum was empty, but to the examining finger the mucosa felt rough and granular. There was a trace of bright red blood on the glove. The patient's temperature was 100° F. and his pulse-rate about 90 per minute on admission. No diagnosis was made.

During the subsequent twelve hours, vomiting occurred at frequent intervals. The vomitus was bile-stained. Hiccuping was troublesome and caused considerable distress. He was incontinent of urine. The pulse-rate increased gradually to 120 per minute. The temperature remained about 100° F.

A radiograph of his abdomen was taken on the morning of March 13. This demonstrated the presence inside the abdomen of three sewing needles, each about 1½ in. in length. Two of these were close together in the umbilical region and the third was situated in the epigastrium to the right of the midline.

Vomiting continued, he lay curled up holding his abdomen and still appeared to be in pain. It was decided that he probably had peritonitis and preparations were made for laparotomy. An intravenous infusion of normal saline and 5 per cent glucose was commenced via the internal saphenous vein at the right ankle. Morphine (gr. ¼) and atropine (gr. $\frac{1}{100}$) were administered half-an-hour before operation.

Under general anæsthesia the abdomen was opened by means of a right lower paramedian incision. The peritoneal cavity contained a moderate quantity of pale yellow creamy pus. A sausage-shaped mass, about twelve inches in length and one and a half inches in diameter, proved on inspection to be an "ileo-ileal" type of intussusception. About one inch distal to the apex of the intussusception two needles were disposed across the lumen at right angles to the long axis of the intestine and approximately at right angles to one another. The points of the needles had penetrated and perforated the wall of the intestine. The needle points therefore were projecting into the peritoneal cavity. Fibrin and pus on the serous peritoneum were evidence of an attempt at localizing the perforations. This attempt had obviously been unsuccessful.

The mass itself was purplish in colour and beginning to lose the normal glossy sheen of the serous peritoneum.

The needles were extracted by taking hold of their points with artery forceps. An unsuccessful attempt was made to reduce the intussusception. Resection was carried out and a side-to-side anastomosis restored the continuity of the gut. The mass of tissue removed was about twelve inches in length. This included the three layers of the intussusception, so that approximately three feet of ileum altogether were resected. The site of the anastomosis was about four feet above the ileo-cæcal valve.

The third needle proved difficult to locate. The specimen was X-rayed but the missing needle was not inside the intussusception. A portable X-ray plant was brought into the operating theatre and an X-ray was taken as the patient lay on the table. The needle was found to be lying in the descending part of the duodenum. It was removed by pushing on the blunt end so that the sharp point penetrated the wall of the duodenum. It was then extracted in the same way as were the other two. The small perforation of the duodenal wall was oversewn using No. 00 catgut on an atraumatic eyeless needle.

The peritoneal cavity was drained.

Post-operative Progress.—Decompression of the upper alimentary tract was maintained by Miller-Abbott tube and continuous aspiration. Fluids and electrolyte loss were replaced by intravenous glucose-saline.

The patient's condition deteriorated. His temperature rose and the respiratory rate increased. He died on March 18, four days after his operation, from a terminal bronchopneumonia.

At Autopsy.—A complete autopsy was performed by Professor C. J. Polson.

The peritoneal cavity contained a moderate quantity of creamy yellow pus. The intestines were distended proximal to the anastomosis. Inflammatory exudate had caused light adhesions between adjacent coils. There was evidence of a small leak at one part of the suture line of the anastomosis.

The mucosa of the ileum some inches distal to the anastomosis presented three small oval-shaped ulcers, all close to one another. The largest of these was about one quarter of an inch in its long axis and had penetrated through all coats of the intestine causing a perforation one sixteenth of an inch in diameter on the serous aspect of the intestine.

There had been no leak from the duodenum.

The lungs and pleuræ: Pleural exudate, in an early stage of organization, covered the upper and lower lobes of the right lung. There was almost uniform consolidation of the lower lobe of this lung, with rib markings towards the apex and appreciable consolidation in the upper lobe. The appearance was that of a confluent bronchopneumonia, rather than a lobar pneumonia.

Areas of consolidation, of a more discrete character, were present in the lower lobe of the left lung.

There were no relevant pathological findings in the other organs.

The patient died from a terminal bronchopneumonia following paralytic ileus and peritonitis, caused by perforation of the intestine and intussusception both apparently the result of ingestion of needles.

THE OPERATION SPECIMEN.—This was composed of approximately two to three feet of ileum. An "ileo-ileal" intussusception had occurred. The apex of the

FIG. 427.—Photograph of specimen. Ileo-ileal intussusception. Outer sheath opened, one needle in situ, second needle removed in opening specimen.

intussusception was dark, blackish red, and covered by a dirty grey slough, apparently in the early stage of gangrene. The rest of the intussusception was tumid through gross œdema, and of a dull purple colour, owing to obstruction of the venous return. The perforations caused by the two needle points were easily seen. Although the two needles were removed at the laparotomy, it was easy to replace them in the exact position they had originally occupied. The photograph clearly demonstrates one of the needles in position—lying across the lumen and its point penetrating the wall and projecting into the peritoneal cavity (*Fig.* 427).

Comment.—It seems reasonable to postulate that the impaction of the needles gave rise to vigorous peristaltic waves in an attempt to dislodge them. These waves, starting several feet above the point of impaction, were presumably responsible for the intussusception.

It could be argued that the needles were pushed on by the apex of an intussusception—but finally becoming impacted transversely across the lumen they prevented any further progress of the intussusceptum. Against this is the fact that the apex was at least one inch above the needles.

Following the occurrence of the intussusception, the penetration of the gut wall gave rise to peritonitis and subsequent paralytic ileus.

The ulcers in the wall of the ileum distal to the surgical anastomosis were post-operative in their development. Presumably they were caused by infected emboli lodging in small terminal end arteries in the wall of the intestine.

I wish to acknowledge my indebtedness to Professor C. J. Polson, of Leeds University, for his account of the autopsy findings, and to Dr. W. McIntosh, Medical Director at St. James's Hospital, Leeds, for his kind permission to publish this case-history.

REVIEWS AND NOTICES OF BOOKS

Tumours of the Eye. By ALGERNON B. REESE, M.D., D.Sc., F.A.C.S., Attending Ophthalmologist and Pathologist, Institute of Ophthalmology, Presbyterian Hospital, New York. Pp. 574 + x, with 511 illustrations, 122 in colour. 1951. London: Cassell & Company Ltd. £7 7s.

THIS large volume devoted to tumour formation in the eye and its coverings is comprehensive and well arranged and beautifully illustrated. Dr. Reese, with more than twenty years of intensive study of orbital tumours, has presented his ideas and figures in a very lucid way. His documentation is excellent and no one can object to his practical and concise classification.

Epithelial tumours of the lids, conjunctivæ, and cornea are portrayed in a very interesting way and illustrated by coloured clinical and microscopical pictures. Surgeons and pathologists have always wondered why the epithelium of the lens does not give rise to any form of neoplasm although mitosis occurs in the lens epithelium throughout life.

The interesting congenital tumour of the eye, the retinoblastoma, is well described and its treatment by radiotherapy using portals through the nose and through the temporal region is very interesting.

The pigmented tumours, angiomatous and bony and cartilaginous tumours are all beautifully depicted and their histology illustrated.

This volume is a mine of information and will remain the reference book on tumours of the eye for a long time.

It is refreshing to see that the author has made use in his extensive bibliography of all the important papers both in America and here.

Psychosurgery. In the Treatment of Mental Disorders and Intractable Pain. By WALTER FREEMAN, M.D., Ph.D., F.A.C.P., and JAMES J. WATTS, M.D., F.A.C.S., F.I.C.S., Washington, D.C. Second edition. 6½ × 10 in. Pp. 598 + xxx, with 160 illustrations. 1951. Springfield, Ill.: Charles C. Thomas. (Oxford: Blackwell Scientific Publications.) 77s. 6d.

IT is eight years since the first edition of this book appeared and the authors tell us that psychosurgery has now come of age, and instance the fact that in Lisbon in 1948 the first international congress on psychosurgery was held. They do not define psychosurgery, however, and the term is an unfortunate one, particularly if we keep in mind its Greek derivation, since these destructive operations on the brain are hardly concerned with, "the breath, the life, or the soul". Osler's dream (or nightmare) in his letter to Cushing which forms a foreword is perhaps more appropriate than may have been intended, for he wrote of "the great principle to create a commotion by which the association paths are restored"; we might add, or broken up! A cynic once remarked that if you hit a watch, which has stopped, with a hammer you can sometimes make it go. This may not be quite the position of leucotomy to-day, but despite diagrams of cerebral architecture from an Economo, an account of the projection fibres of the frontal cortex, the assumed functions of the lobes and the results of their injury, the impression gained is that leucotomy for mental states or pain can hardly yet be described as scientific or its effects accurately predictable. The summaries of results, however, make an important contribution to our knowledge of brain injury and the effects of the operation. Some reports are as long as ten years after operation.

In the chapter on damaged frontal lobes there is no reference to the now classical case, reported by Bigelow, of Phineas P. Gage, of the Portland and Burlington Railroad.

Freeman and Watts believe that the frontal lobes are responsible for foresight and insight, and that such are the qualities which are impaired by transection operations on the lobes. Whether their loss, along with the possibility of other complications, is too high a price to pay for a certain amount of relief from some of the conditions for which leucotomy has been performed and which are here set forth, is for the reader to decide. As Carlyle told us, "man's unhappiness comes of his greatness". A slap-happy, carefree, subnormal euphoric produced by surgery is not a very pleasant idea whatever he may replace, and, as a recent writer in the *British Medical Journal* has stated, leucotomy is too close a derivative of medieval trephining in mental disorders to allow us to feel comfortable about it.

The authors have done well, however, to record their experiences for us and the book is well produced and easily read.

The Thyroid. By THOMAS HODGE MCGAVACK, B.A., M.D., F.A.C.P., Professor of Clinical Medicine, New York Medical College; etc. With a Section on Surgery by JAMES A. WINFIELD, B.A., M.D., F.A.C.S., Professor and Director of Surgery, New York Medical College, and WALTER L. MERSHEIMER, B.S., M.D., F.A.C.S., Associate Professor of Surgery. New York Medical College; and a Section on History by DOROTHY B. SPEAR, Ph.B., Librarian, and THOMAS HODGE MCGAVACK. $6\frac{3}{4} \times 9\frac{3}{4}$ in. Pp. 646, with 72 illustrations. 1951. London: Henry Kimpton. 95s.

THIS is a comprehensive volume dealing with all aspects of thyroid disease. Dorothy B. Spear and the author contribute an interesting chapter on the early history and folklore of goitre. The chemical and physical considerations of the metabolism of iodine are dealt with in a very practical and interesting manner. The various anti-thyroid compounds are described and their nature explained.

James A. Winfield and Walter L. Merscheimer contribute a section dealing with the surgery of the thyroid. This section deals not only with the operative technique but also with the pre-operative preparation of the patient and with the post-operative care.

The book contains a very full bibliography of the international literature dealing with thyroid disease. It should prove a valuable reference volume to all who are interested in the human thyroid and its diseases.

Essays in Surgery. Presented to Dr. W. E. Gallie on the Occasion of his Retirement from the Chair of Surgery in the University of Toronto. $6\frac{1}{4} \times 9\frac{1}{8}$ in. Pp. 584 + xxiv. Illustrated. 1950. Toronto: University of Toronto Press. (London: Geoffrey Cumberlege.) 75s.

IT is given to few men to have a book dedicated to their name and work. Professor Gallie may well be proud of this book which contains just under sixty articles written by his colleagues and former students and presented to him on his retirement from the Chair of Surgery in the University of Toronto. Gallie, although most interested in the surgery of the bones and joints, was a general surgeon at heart and published many interesting articles dealing with such conditions as pyloric stenosis in infants and hæmolytic jaundice. His contribution to surgery on the use of living sutures in the repair of herniæ will always be remembered.

Every branch of surgery is dealt with in the book of essays; Charles Best writes on heparin in blood clotting and thrombosis, while Frank Turnbull deals with pre-frontal leucotomy, and Le Mesurier with cleft palate. It is only natural that orthopædic surgery would be amply represented in this book and Bateman has contributed an article on peripheral nerve injuries, Dickson on ununited fractures of the femoral neck, and Dale on end-bearing amputations.

This book will be read with interest by surgeons the world over for it contains the thoughts and experiences of those engaged in practical research. It will take its place beside the Birthday Volume of Robert Jones.

Chest X-ray Diagnosis. By MAX RITVO, M.D., Assistant Professor of Radiology, Harvard Medical School; etc. 7 × 10¼ in. Pp. 558, with 418 illustrations. 1951. London: Henry Kimpton. £5 5s.

THIS book is the outcome of the experience of the author over the last thirty years. X-ray examination of the chest becomes more significant each year, for the profession as a whole has accepted this method as an important adjunct to the clinical examination of the patient. With the annual increase of cancer of the lung it is essential that an early diagnosis should be made if surgery is employed to eradicate the disease.

This volume, which is full of excellent radiographs illustrating both the early and the late stages of all thoracic diseases, will take its place in the library of all clinicians for it is a really useful book. As a reference volume it could not be bettered.

The Mode of Action of Anæsthetics. By T. A. B. HARRIS, M.B., B.S., D.A., F.F.A.R.C.S. $5\frac{1}{2} \times 8\frac{1}{2}$ in. 716 pages with 22 illustrations. 1951. Edinburgh: E. & S. Livingstone Ltd. 42s.

THE main purpose of this book is to explain the mode of action of anæsthetics, and the author, besides presenting a great quantity of information, also stimulates the reader's interest in a number of aspects of modern anæsthesia. The opinion of the reader will not always agree with that of the author, although most statements are supported by a wealth of references.

The book is divided into four parts: the first deals with narcotics; the second with anæsthetics; the third with the correlation of the level of anæsthetic depression of the nervous system with anæsthetic sleep, loss of sensation, muscle movements and tone; Part IV comprises a complete survey of metabolism during anæsthesia and concludes with an excellent chapter on anæsthetic explosions.

This manual is well arranged, clearly printed, and the illustrations, although somewhat few in number, are well produced. Great changes in anæsthesia have occurred in the last two decades, and the specialty is now known as "anæsthesiology" in the United States of America. The modern anæsthetist should be fully knowledgeable in regard to the pharmacological, physiological, and pathological aspects of his specialty, and we congratulate the author on producing a manual worthy of study by post-graduate students who intend to become consultants and teachers of anæsthetics.

Roentgen Manifestations of Pancreatic Disease. By MAXWELL H. POPPEL, M.D., F.A.C.R., Associate Professor of Clinical Radiology, New York University, Bellevue Medical Centre. Pp. 389 + xiii. 1951. Springfield, Ill.: Charles C. Thomas. (Oxford: Blackwell Scientific Publications.) 77s. 6d.

EACH year the surgery of the pancreas becomes more important as the early diagnosis of carcinoma of the organ is more frequently recognized. Good X-ray pictures do help in this early diagnosis and Professor Poppel has written an excellent book on this subject. Not only congenital variants of the organ such as annular pancreas,

but congenital variants of the common and pancreatic ducts can be seen in some radiographs.

Pancreatic calculi and pancreatic cysts, especially if calcified, can be seen in X-ray films. But it is in the sphere of cancer that radiographs are of real value in the early diagnosis of the condition.

The author has collected a series of wonderful films, many of which could not be replaced as they are the only ones in existence. These films have been beautifully reproduced and the book will become the standard reference volume on X-ray manifestations of pancreatic disease.

Anatomy in Surgery. By PHILIP THOREK, M.D., F.A.C.S., F.I.C.S., Assistant Clinical Professor of Surgery, University of Illinois College of Surgeons. Pp. 970 + xxiv, with 720 illustrations, 211 in colour. 1951. London: J. B. Lippincott Co. £9.

THIS is an excellent volume full of useful practical information and beautiful original drawings; we have only one fault to find with it and that is its price. Few medical men, and certainly no students, can afford the price of nine pounds for a single reference book under conditons which prevail in this country.

However, Philip Thorek is to be congratulated on his excellent production, for a sound knowledge of anatomy is still essential for any practical surgeon. There has been a tendency between the two world wars to belittle anatomy and to put all the emphasis on physiology in the training of the modern surgeon. To-day teachers of surgery are again preaching the importance of anatomy in the make-up of the surgeon. It is a great pity that more surgical anatomy is not taught in our medical schools. Surgical anatomy should be taught to medical students when they start dissecting, as the practical application of anatomy is always a stimulus to the average student.

Professor Thorek has illustrated anatomically all the modern operative approaches to such conditions as a patent ductus arteriosus and an enlarged thymus or retrosternal goitre. These give an impression, especially to the student, of the real importance of such structures. It is a pity, however, that the author describes and illustrates a pararectal incision in the abdominal wall; such an incision has no value whatever and is a dangerous one to advocate. It should be prohibited, as it so likely to damage some of the lower intercostal nerves and so lead to an incisional hernia.

Surgeons and anatomists will find much to value in this book and it will take its place as a reference volume on surgical anatomy.

Joll's Diseases of the Thyroid Gland. By FRANCIS F. RUNDLE, M.D., F.R.C.S., The Unit of Clinical Investigation, The Royal North Shore Hospital of Sydney, Australia; etc. Second edition. 7⅞ × 9¾ in. Pp. 520 + x, with 165 illustrations. 1951. London: William Heinemann Medical Books Ltd. 84s.

NEARLY twenty long years have elapsed since Cecil Joll's book on *Diseases of the Thyroid Gland* was published in 1932. The book had become a classic and was read not only by surgeons who were interested in the surgery of the thyroid but by a host of other medical men and women who were interested in the various aspects of thyroid dysfunction and disease. Now the second edition has appeared under the editorship of Mr. Rundle, who has carried on the great tradition which Cecil Joll left behind. The format of the book is new and the type has been reset; the whole volume is not too bulky and makes for easy reading. The illustrations are numerous and on the whole are good, but surely something better could have been included depicting the operative technique of thyroidectomy. The illustrations on pages 445, 449, 451, and 457 contrast severely with the rest of the pictures in the book.

Mr. Rundle has performed a great task in this second edition and British surgery owes him a debt of gratitude for this service. His own knowledge of the pathology and treatment of thyrotoxicosis is large, and he has the added ability of being able to write in a lucid and interesting manner.

We feel that Cecil Joll himself would approve of this second edition.

Surgery of the Stomach and Duodenum. By CLAUDE E. WELCH, M.D., Associate Visiting Surgeon, Massachusetts General Hospital; etc. 5¾ × 8¼ in. Pp. 349, with 79 illustrations by MURIEL MCLATCHIE MILLER. 1951. Chicago: The Year Book Publishers Inc. $8.50.

THIS handbook of operative surgery is dedicated to Arthur W. Allen, so well known both in the United States and in England. The book is well planned and well illustrated and should act as a practical guide for younger surgeons and registrars who want to know alternative methods of operative technique on the stomach and duodenum.

There are some seventy-eight illustrative plates depicting the various operative procedures in use at the Massachusetts General Hospital. These black-and-white drawings are excellent and are not spoilt by too much detail.

A useful book which should prove to be popular.

BOOK NOTICES

[*The Editorial Committee acknowledge with thanks the receipt of the following volumes. A selection will be made from these for review, precedence being given to new books and to those having the greatest interest to our readers.*]

The Early Diagnosis of the Acute Abdomen. By ZACHARY COPE, B.A., M.D., M.S. (Lond.), F.R.C.S. (Eng.), Consulting Surgeon to St. Mary's Hospital, etc. Tenth edition. 5¾ × 8¾ in. Pp. 270 + xvi, with 39 illustrations. 1951. London: Oxford University Press. 15s.

Functional Neuro-Anatomy. Including an Atlas of the Brain Stem. By A. R. BUCHANAN, M.D., Professor of Anatomy, University of Colorado School of Medicine, Denver, Colorado. Second edition. 7 × 10¼ in. Pp. 323, with 273 illustrations. 1951. London: Henry Kimpton. 52s. 6d.

The Management of Fractures, Dislocations, and Sprains. By JOHN ALBERT KEY, B.S., M.D., St. Louis, Missouri; and H. EARLE CONWELL, M.D., F.A.C.S., Birmingham, Alabama. Fifth edition. 6¾ × 10 in. Pp. 1232, with 1195 illustrations. 1951. London: Henry Kimpton. 115s.